GRAND CANYON
NATIONAL PARK AIRPORT
ARIZONA

Chapter Six

CONCEPT/FINANCIAL PLAN

AIRPORT MASTER PLAN

ADOT

Chapter Six

MASTER PLAN CONCEPT/ FINANCIAL PLAN

The process for the preparation of the Airport Master Plan has included technical efforts in the previous chapters intended to confirm the role of Grand Canyon National Park Airport (GCN or Airport), forecast potential aviation demand, establish airside and landside facility needs, and evaluate alternatives for improving the Airport to meet those facility needs. The planning process has included the development of draft working papers that have been presented to the Planning Advisory Committee (PAC), Arizona Department of Transportation (ADOT), Federal Aviation Administration (FAA), and Airport management. Additionally, a series of Public Information Workshops have been conducted as part of this planning process, providing the public an opportunity to be involved and educated about the study.

The next step is to provide a recommended Master Plan Concept which consists of a 20-year vision for the Airport. In the previous chapter, several alternatives were considered and evaluated for the potential future development of airside and landside facilities at the Airport. Each alternative offered a differing approach to facility development, and the layouts were presented for the purposes of evaluation. Since then, the alternatives have been refined into a single development plan for the Master Plan.

One of the objectives of the Master Plan is to allow decision-makers the ability to either accelerate or slow development goals based on actual demand. If demand slows, development of the Airport beyond routine safety and maintenance projects could be minimized. If aviation demand accelerates, development could be expedited. Any plan can account for limited development, but the lack of a plan for growth can sometimes be challenging. Therefore, to ensure flexibility in planning and development to respond to unforeseen needs, the Master Plan Concept considers the full and balanced development potential for GCN.

GRAND CANYON
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MASTER PLAN CONCEPT

GCN is classified by the Federal Aviation Administration (FAA) as a non-hub, primary commercial service airport. The airport is also included in the FAA's *National Plan of Integrated Airport Systems* (NPIAS). NPIAS airports are considered important to the national aviation system and are eligible for development grant funding from the FAA. At the state level, the Arizona Department of Transportation – Multi-Modal Planning Division – Aeronautics Group (ADOT-MPD – Aeronautics Group) also classifies GCN as a primary commercial service airport.

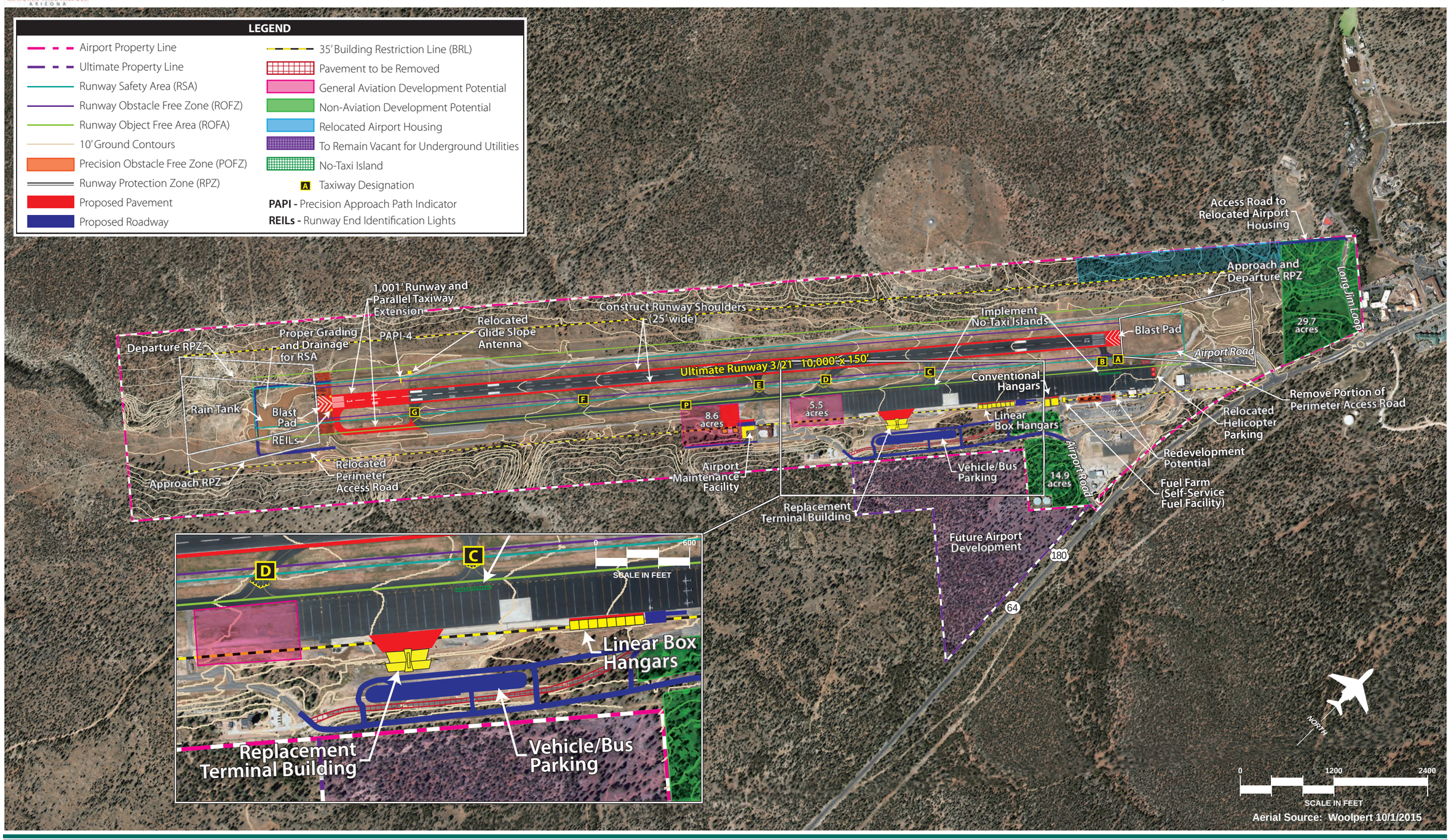
The Master Plan Concept, as shown on **Exhibit 6A**, presents the recommended configuration for the Airport, which preserves the role of the facility while meeting FAA design and safety standards to the extent practicable. It is important to note that the concept provides for anticipated facility needs over the next 20 years, as well as establishing a vision and direction for meeting facility needs beyond the 20-year planning period of this study. A phased program to achieve the recommended Master Plan Concept is presented later in this chapter. While the Master Plan Concept makes recommendations for the future of GCN, it is important to continue to gain local perspective and input on important development goals and objectives. The following sections describe the Master Plan Concept. When assessing development needs, the development plan has separated the Airport into airside and landside functional areas.

AIRSIDE DEVELOPMENT CONCEPT

The airside plan generally considers those improvements related to the runway and taxiway system and often requires the greatest commitment of land area to meet the physical layout of an airport. Operational activity at GCN is anticipated to grow through the 20-year planning horizon of this Master Plan, and the Airport is projected to continue to serve the full range of aircraft operations, including commercial service/air charter, air taxi/tour, general aviation, and military activities.

The major airside issues addressed in the Master Plan Concept include the following:

- Adhere to ultimate Runway Design Code (RDC) C-III standards on Runway 3-21.
- Extend Runway 3-21 1,001 feet to the southwest, thus providing an overall runway length of 10,000 feet. Further justification and coordination with the FAA will be needed prior to any potential runway extension.
- Improve safety area deficiencies that currently exist on Runway 3-21.
- Construct paved shoulders on Runway 3-21.
- Construct blast pads serving each end of Runway 3-21.
- Implement "No Taxi Islands" at certain taxiway intersections in order to improve airfield geometry.
- Enhance visual approach aids on the runway system.


LEGEND
Airport Property Line
Ultimate Property Line
Runway Safety Area (RSA)
Runway Obstacle Free Zone (ROFZ)
Runway Object Free Area (ROFA)
10' Ground Contours
Precision Obstacle Free Zone (POFZ)
Runway Protection Zone (RPZ)
Proposed Pavement
Proposed Roadway
35' Building Restriction Line (BRL)
Pavement to be Removed
General Aviation Development Potential
Non-Aviation Development Potential
Relocated Airport Housing
To Remain Vacant for Underground Utilities
No-Taxi Island
A Taxiway Designation
PAPI - Precision Approach Path Indicator
REILs - Runway End Identification Lights
Access Road to Relocated Airport Housing
Approach and Departure RPZ
Long Jim Loop
29.7 acres
1,001' Runway and Parallel Taxiway Extension
Construct Runway Shoulders (25' wide)
Implement No-Taxi Islands
Blast Pad
Airport Road
Departure RPZ
Proper Grading and Drainage for RSA
PAPI-4
Relocated Glide Slope Antenna
Ultimate Runway 3/21 10,000' x 150'
Conventional Hangars
Remove Portion of Perimeter Access Road
Rain Tank
Blast Pad
REILs
8.6 acres
5.5 acres
Linear Box Hangars
Relocated Helicopter Parking
Redevelopment Potential
Relocated Perimeter Access Road
Airport Maintenance Facility
Vehicle/Bus Parking
14.9 acres
Airport Road
Fuel Farm (Self-Service Fuel Facility)
Approach RPZ
Replacement Terminal Building
Future Airport Development
180
64
0
600
SCALE IN FEET
Linear Box Hangars
Replacement Terminal Building
Vehicle/Bus Parking
NORTH
0
1200
2400
SCALE IN FEET
Aerial Source: Woolpert 10/1/2015

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Runway Dimensional Standards

The FAA has established design criteria to define the physical dimensions of the runways and taxiways, as well as the imaginary surfaces surrounding them which protect the safe operation of aircraft at airports. These design standards also define the criteria for the placement of landside facilities.

As discussed previously, the design criteria primarily center on an airport's critical design aircraft. The critical design aircraft is the most demanding aircraft or family of aircraft which currently, or are projected to, conduct 500 or more operations (takeoffs or landings) per year at an airport. Factors included in airport design are an aircraft's wingspan, approach speed, tail height, and, in some cases, the instrument approach visibility minimums for each runway. The FAA has established the RDC to relate these design aircraft factors to airfield design standards. The most restrictive RDC is also considered the overall Airport Reference Code (ARC) for an airport with more than one runway.

Analyses in Chapters Four and Five concluded that the current RDC for Runway 3-21 is C-II. Future planning considers an ultimate RDC of C-III for Runway 3-21. The future RDC is planned to be C-III for the following reasons:

- The existing runway geometry has long been planned to C-III standards;
- The runway should be planned for some of the most demanding regional commercial service and air charter aircraft given its runway length; and
- The runway meets the majority of C-III design standards except for those outlined in the following sections that are addressed in the Master Plan Concept.

Table 6A provides a summary of the RDC for Runway 3-21 based upon the Master Plan Concept. In addition to the physical and operational components of an aircraft, the RDC also considers the instrument approach capabilities for each runway expressed in runway visual range (RVR) values. For Runway 3-21, the RVR value of 4,000 feet indicates approach visibility minimums not lower than ¾-mile, which currently correspond to the precision instrument landing system (ILS) approach to Runway 3. Note: The previously approved Airport Layout Plan (ALP) presented in Chapter Five indicated an existing and ultimate ARC C-III planning standard for Runway 3-21.

TABLE 6A
Runway Design Code
Grand Canyon National Park Airport

Runway	Planned Runway Design Code*
3-21	C-III-4000

* The ultimate ARC for GCN is C-III based upon the RDC designation for Runway 3-21.

Runway 3-21 Length

The Master Plan Concept includes extending Runway 3-21 1,001 feet to the southwest in order to better support the needs of larger commercial service/air charter aircraft in the event that the Airport experiences a significant enhancement in commercial passenger service in the future. This will allow for 10,000 feet of physical runway length, which is previously called for in the 2005 Master Plan and 2009 ALP.

While this Master Plan can address the potential need for additional runway length in the future, that need remains to be fully justified. As with any major capital expenditure on an airport, specific justification will be needed for the FAA to commit to funding such a project. This will require highly specific justification outlined by the potential airline and/or air charter operations serving the Airport. The proposed 1,001-foot extension on Runway 3-21 would also result in environmental impacts, which would need to be addressed prior to the actual design and construction of the extension. As a result, it is important that Airport personnel continue to monitor a potential need for additional runway length and coordinate with the FAA accordingly.

As previously detailed, a southwesterly extension will not be an easy undertaking, given the physical land constraints beyond the end of the runway. The freshwater pond, known as Rain Tank, is situated beginning approximately 1,500 feet southwest of the runway threshold. In order to satisfy the safety design standards associated with a 1,001-foot runway extension to the southwest, a significant area of land at least 1,000 feet beyond the end of the proposed runway threshold would need to be cleared and graded. This would involve the removal of Rain Tank. As noted above, a detailed environmental analysis (at least an Environmental Assessment) would need to be undertaken to further evaluate the impacts of removing Rain Tank and preparing the land for a potential runway extension. Further information related to Rain Tank is provided in *Appendix B – Environmental Overview* of the Master Plan.

It should be noted that the existence of Rain Tank currently serves as a significant hazard to aircraft operations due to its ability to attract wildlife. Because it is one of very few water bodies located near GCN, it attracts various species of birds and mammals and brings them close to aircraft on arrival to and departure from the runway system. Some of the larger bird species can be hazardous to aircraft operations and have the potential to cause significant damage or effect on aircraft flight. According to the *Grand Canyon National Park Airport Wildlife Hazard Assessment* completed in 2016, Rain Tank poses a high risk to airport operations and is considered a critical priority for the Airport to continually monitor.

In order to accommodate a 1,001-foot extension, the glideslope antenna associated with the precision ILS approach on Runway 3 would need to be relocated. According to the FAA, glideslope antennas can be sited between 750 feet and 1,250 feet from a runway threshold. The proposed extension would shift the runway threshold approximately 2,000 feet from the existing glideslope antenna, thus necessitating its relocation.

The FAA has also indicated that any change to the runway environment must also conform to a runway protection zone (RPZ) being free of incompatible land uses, including residences. As detailed on **Exhibit 6A**, the RPZ associated with the proposed runway extension stretches farther southwest but remains on

existing airport property and free from incompatible land uses except for the existence of Rain Tank, which would have to be removed as detailed above.

Runway Safety Enhancements

The existing and ultimate runway safety area (RSA) and runway object free area (ROFA) beyond the northeast end of the runway are currently penetrated. The Master Plan Concept calls out a portion of the perimeter access road to be removed that obstructs the RSA, beginning approximately 650 feet beyond the runway end. Although the road is restricted to authorized airport personnel only and is not open to the public, the FAA recommends it be clear of the RSA. One option is to relocate the portion of the roadway outside the RSA, while another option could be to utilize an existing access gate farther north, adjacent to the west side of Airport Road for authorized vehicles to enter in order to conduct airfield inspections or service navigational aid equipment.

Similar to the RSA, the ROFA is also obstructed on the northeast side of the runway. Two marked helicopter landing areas are situated approximately 600 feet beyond the runway end. Future planning considers the removal and relocation of the helicopter landing areas outside the ROFA. In addition, a retaining wall and associated fencing, as well as portions of Airport Road, fall within the ROFA, beginning 714 feet beyond the runway end. Relocating portions of Airport Road and the retaining wall and associated fencing would prove to be very costly given the amount of ROFA affected. Furthermore, the relocation of the roadway would affect existing landside infrastructure associated with the Papillon Helicopters air tour facility directly north. As such, a Modification to Standard could be considered for this nonstandard condition related to the ROFA. Further coordination with the FAA would be needed to request, and ultimately approve, a Modification to Standard.

Certain portions of the airfield between Runway 3-21 and parallel Taxiway P do not meet RSA grading standards due to a series of culverts that aid in airfield drainage. The Airport is aware of this issue and the capital program to be discussed later in this chapter designates a project that will meet full RSA safety standards, adjacent to the east side of the runway system. In addition, portions of the ROFA are obstructed by trees and shrubs along the west side of the runway. Similarly, the capital program calls for a project that would clear the ROFA of these penetrations.

As previously detailed in Chapter Five, a portion of the approach and departure runway protection zones (RPZs) beyond the north end of Runway 3-21 have incompatibilities in the form of Airport Road, as well as a portion of a building and vehicle parking lot associated with Papillon Helicopters. While the FAA recommends that these RPZs be free of these incompatibilities, existing conditions may be “grandfathered” under certain circumstances as long as no changes are being proposed to the runway end environment. The Master Plan Concept does not propose any changes to the northeast end of Runway 3-21 that would alter the location of the landing threshold or size of the RPZs; therefore, it can be assumed that these conditions will be allowed to remain pending ongoing coordination with the FAA.

***Important Note related to the Airport Road/RPZ issue:** Per previous coordination between the FAA and ADOT, it has been determined that the portion of Airport Road located within the existing/ultimate RPZ located on the north side of Runway 3-21 is allowed to remain in its existing location; however, that portion of Airport Road is ineligible for future Airport Improvement Program (AIP) funding due to its incompatible use within the RPZ. It has also been determined that the building associated with Papillon Helicopters can remain in its existing location since the portion of the building within the RPZ is not occupied.

Runway Shoulders

The Master Plan Concept calls for the construction of 25-foot paved shoulders on each side of Runway 3-21. Paved shoulders are recommended by the FAA for runways accommodating Airplane Design Group (ADG) III aircraft.

As previously detailed, a recent survey of the runway system indicates that Runway 3-21 is approximately 148 feet wide. Future improvements to the runway system include increasing the width to 150 feet to meet proper runway design standards. This project should be planned during the same time as the runway shoulder improvements.

Runway Blast Pads

The Master Plan Concept considers constructing blast pads on each end of Runway 3-21. The blast pads should measure 200 feet by 200 feet in order to meet ultimate RDC C-III standards. It is recommended that the new blast pad associated with Runway 3 be considered on the existing runway end in the event that the runway extension does not occur as proposed. If a runway extension were to ultimately occur, a new blast pad should also be considered for the ultimate runway configuration.

Taxiway Design and Geometry Enhancements

While no significant airfield capacity improvements should be necessary during the course of the planning period, the Master Plan Concept considers improving airfield efficiency by extending parallel Taxiway P to serve the proposed southwesterly extension on Runway 3-21.

A safety project involving taxiway geometry at GCN is planned to ensure that direct access from an aircraft parking apron to runway is not provided. Configurations that allow for direct access from an apron to runway have been targeted as they tend to increase risks for runway incursions. The Master Plan Concept ultimately calls for the implementation of two “No Taxi Islands” in proximity to Taxiways A, B, and C, which directly connect the runway environment and parking apron farther east. Given the small separation between Taxiways A and B, it is recommended that one “No Taxi Island” be implemented in this area. The second “No Taxi Island” would be situated farther south adjacent to Taxiway C. In order

to enhance the presence of these "No Taxi Islands," medium intensity taxiway lighting (MITL) could be implemented adjacent to the affected pavement that would allow pilots to better distinguish the markings and increase airfield situational awareness.

It should be noted that the previous chapter detailed alternatives that could mitigate the FAA-designated Hot Spot on the north side of airfield associated with the close proximity of Taxiways A and B. Three alternatives were evaluated to help bring clarity to the separation of Taxiways A and B. The following were the primary considerations:

1) Convert existing Taxiway A to a hold apron;
2) Convert existing Taxiway B to Taxiway A and construct a new Taxiway B farther south;
3) Implement a displaced threshold on Runway 3-21 that would allow for an extension of Taxiway A to the west.

Through the alternatives evaluation, GCN airport traffic control tower (ATCT) personnel were consulted. They confirmed the importance of having both taxiways to serve the capacity and efficiency of the airfield network and recommended that the existing layout of Taxiways A and B be maintained. As such, the Master Plan Concept considers no change to the taxiway structure associated with the designated Hot Spot and suggests that ATCT personnel should continue to carefully advise aircraft taxiing in this area.

Visual Approach Aids

Future planning considers enhancements to visual approach aids serving Runway 3-21 at GCN, as depicted on **Exhibit 6A**. Currently, Runway 21 is served by a four-box visual approach slope indicator (VASI-4). The Master Plan Concept recommends ultimately replacing the VASI-4 with a four-box precision approach path indicator (PAPI-4). The PAPI is a more current system that has the ability to better adhere to equipment upgrades. It should be noted that a PAPI-4 has recently been implemented on the Runway 21 end, thus replacing the need for a VASI-4. A PAPI-4 system is also proposed to serve the Runway 3 end. It is recommended that a PAPI system be implemented on this runway end in the short term. A potential runway extension would require the ultimate relocation of the PAPI.

Another visual approach aid enhancement to the runway system is runway end identification lights (REILs). REILs are currently in place on Runway 21. The FAA recommends that REILs be considered for implementation on runway ends not served by a more sophisticated approach lighting system. Since a medium intensity approach lighting system (MALS) no longer serves Runway 3, the plan considers REILs serving this runway end. Similar to the PAPI system being proposed, it is recommended that REILs be implemented to the existing runway environment in the short term. The proposed runway extension would then require the ultimate relocation of the REILs.

Runway Pavement Strength

The current strength rating on Runway 3-21 is reported to be 88,000 pounds single wheel loading (SWL), 108,000 pounds dual wheel loading (DWL), and 160,000 pounds dual tandem wheel loading (DTWL). It should be noted that the FAA is moving toward the use of the Pavement Classification Number (PCN) rating rather than a weight limit/wheel loading designation to publish pavement strength. The PCN is a five-part code described as follows:

1) PCN Numerical Value: Indicates the load-carrying capacity of the pavement expressed as a whole number. The value is calculated based on a number of engineering factors, such as aircraft geometry and pavement usage.
2) Pavement Type: Expressed as either R for rigid pavement (most typically concrete) or F for flexible pavement (most typically asphalt).
3) Subgrade Strength: Expressed as A (High), B (Medium), C (Low), D (Ultra Low). A subgrade of A would be considered very strong, like concrete-stabilized clay, and a subgrade of D would be very weak, like un-compacted soil.
4) Maximum Tire Pressure: Expressed as W (Unlimited/No Pressure Limit), X (High/254 psi), Y (Medium/181 psi), or Z (Low/72 psi), this indicates the maximum tire pressure the pavement can support. Concrete surfaces are usually rated W.
5) Process of Determination: Expressed as either T (technical evaluation) or U (physical evaluation), this indicates how the pavement was tested.

The published PCN rating for Runway 3-21 is 52/F/C/W/T.

Airside Conclusion

A significant driver of the long term plan for the runway/taxiway system is the FAA requirement that design and airfield geometry standards be met to the greatest degree feasible. Solutions to non-standard situations are to be depicted on the ALP. Future discussions with FAA (and ADOT-MPD – Aeronautics Group) will determine the timeframe for undertaking those projects that involve enhancing airfield safety. Many factors are considered when making project timing determinations, including the level of safety concern, a benefit-cost determination, and funding availability.

The most significant feature of the airside plan is the proposed 1,001-foot extension of Runway 3-21 to the southwest in order to accommodate the potential for enhanced commercial passenger service aircraft that could utilize the airport through the long term planning period. In order to accommodate any extension to the southwest, significant improvements would be needed to clear and grade the affected area to meet design standards and increase safety of aircraft operations. As with any significant capital project, further coordination will be needed with the FAA prior to construction to provide justification for the project and secure proper environmental clearances.

A variety of other projects are also recommended that involve improvements to the runway system. These include implementing paved shoulders, constructing blast pads on each runway end, and enhancing visual approach aids in the form of PAPI-4s and REILs.

LANDSIDE DEVELOPMENT CONCEPT

Landside components include terminal buildings, hangars, aircraft parking aprons, and aviation support services, as well as the utilization of remaining airport property to provide revenue support and to benefit the economic well-being of the regional area. The primary goal of landside facility planning is to provide adequate passenger terminal facilities and aircraft storage space to meet forecast needs, while also maximizing operational efficiencies and land uses. Also important is identifying the overall land use classification of airport property in order to preserve the aviation purpose of the facility well into the future. **Exhibit 6A** presents the view of the planned landside development for GCN.

There are numerous facility layout concepts that could be considered. Detailed layouts of potential landside facilities were presented in Chapter Five that included replacement passenger terminal building layouts, hangar development, and the placement of aviation support services. The Master Plan Concept provides the layout of proposed landside facilities which attempts to maximize potential aviation development space on the airfield.

The major landside issues addressed in the Master Plan Concept include the following:

- Upgrades/replacement of the passenger terminal building and associated infrastructure to meet future commercial passenger service needs.
- Designate areas that can accommodate aviation development/redevelopment potential on the Airport to include aircraft storage hangars.
- Construct a dedicated maintenance facility to support equipment storage.
- Implement a new fuel farm with the ability to accommodate self-service aircraft fueling.
- Potential relocation of Airport housing in order to capitalize on non-aviation development potential for the Airport.
- Designate non-aviation development on Airport property to further enhance Airport revenues.

Passenger Terminal Building Upgrades/Replacement

GCN has a dedicated terminal building that encompasses approximately 8,500 square feet of usable space for various aviation-related activities. Previous analysis has indicated that the existing layout of the facility does not provide adequate space and functionality to serve passenger service components for existing use or for future commercial passenger airline/air charter demands. Furthermore, given its age, renovations are needed to meet updated International Building Code (IBC) standards, as well as *Americans with Disabilities Act* (ADA) compliance upgrades. Chapter Five detailed several projects that

should be considered for the building to better adhere to IBC and ADA compliance standards, as well as accommodate commercial passenger service functions or the future repurposing of the facility. The Master Plan Concept recommends short term improvements to the existing terminal building as outlined in the capital program detailed later in the chapter.

In order to better meet the long term demands being projected for commercial passenger service/air charter activity, the Master Plan Concept also ultimately calls for a new replacement terminal building. Alternatives were evaluated in the previous chapter that presented three different locations for a replacement facility that included:

1) A new replacement terminal building in the same approximate location as the existing terminal;
2) A new replacement terminal building beginning approximately 100 feet south of the existing terminal located at the convergence of Airport Road;
3) A new replacement terminal building located farther south in an area adjacent to the south parking apron.

Through the alternatives evaluation, the location farther south in an area adjacent to the main aircraft parking apron that is also in a midfield location with relationship to the runway system, is proposed as shown on **Exhibit 6A**. It should be noted that this terminal location is closely aligned to the recommended development concept associated with the 2009 Terminal Area Plan. The new terminal facility is envisioned to contain approximately 30,000 square feet of building space, with the ability to be expanded to 40,000 square feet as demand would dictate. As presented in Chapter Five, this site offers a more secure location for commercial passenger service/air charter activities as it would be segregated from general aviation activities, as well as provide increased area for aircraft movement and circulation, adjacent to the aircraft parking apron that is currently underutilized.

On the east side of the replacement terminal, the site offers space for a large parking area that could accommodate vehicles, bus staging, and potential rental car operations. New roadways extending south from Airport Road would provide access to the replacement terminal facility and parking alignment. Given that there is no significant development in close proximity to the proposed terminal site, additional infrastructure in the form of utilities would be needed. Similar to other significant developments being proposed in the Master Plan Concept, the replacement terminal building would require extensive environmental and design evaluations prior to construction.

It is important to consider sustainable solutions into the design of a new replacement terminal facility. Chapter Five outlined several sustainability initiatives that could be considered with a new terminal building to include solar systems and water harvesting. Chapter Seven of this study provides a Sustainability Management Plan that further details these potential sustainability initiatives and many others that could be incorporated into the design and construction of a new replacement terminal building at GCN.

General Aviation/Hangar Development

The ultimate relocation of the passenger terminal building as previously outlined would allow for significant development and redevelopment potential in the north area of the airfield. The landside development concept also proposes the location of certain hangar types by primarily following the philosophy of separation of activity levels. The plan depicts hangar development/redevelopment items that include the following:

- Construction of two larger conventional hangars that could support high levels of aviation activity typically associated with fixed base operators (FBOs) and specialized aviation service operators (SASOs).
- Construction of eight linear box hangars to satisfy aircraft storage and potential SASO activities.
- Redevelopment potential within the area that currently accommodates the passenger terminal building that could serve general aviation and air tour operation activities. This could include repurposing the existing terminal building for airport-related uses.
- Two separate parcels south of the proposed replacement terminal building that total approximately 14 acres of land for aviation development potential.

Table 6B presents the total hangar and development/redevelopment areas proposed in the landside development plan. As can be seen from the table, the layout provides nearly 49,000 square feet of additional hangar space, which exceeds the amount of hangar space needed through the long term planning period based upon the aviation demand forecasts. Therefore, the hangar layout presented can represent a vision for the Airport that extends beyond the scope of this study. The reason for this is to provide decision-makers with dedicated areas on the Airport that should be reserved for certain hangar types. Furthermore, nearly 15 acres of land is highlighted for potential development and redevelopment, as demand would dictate, that could accommodate aircraft storage and other specialty aviation support services.

TABLE 6B
Aircraft Hangar and Development Space Planned
Grand Canyon National Park Airport

Aircraft Hangar and Development Parcels	Provided in Master Plan Concept
Linear Box Hangar Area	28,800 s.f.
Conventional Hangar Area	20,000 s.f.
Redevelopment of Existing Terminal Area	0.8 acres
Aviation Development Parcel South of Proposed Terminal	5.5 acres
Aviation Development Parcel South of Airport Rescue and Firefighting Facility	8.6 acres

It should be noted that the Master Plan Concept includes the depiction of a 35-foot building restriction line (BRL) on the east and west sides of the runway. Chapter Five provided a detailed description of the

BRL, which is a product of Title 14 Code of Federal Regulations (CFR) Part 77 transitional surface requirements.

Portions of existing and proposed hangars and other facilities on the east side of the airfield are situated within the 35-foot BRL as shown on **Exhibit 6A**. The majority of these facilities contain roof peaks that do not constitute a penetration to the 35-foot BRL. Future consideration will need to be given when constructing hangars and other facilities at the Airport; however, the areas considered for development and redevelopment should be able to accommodate an array of hangar types without penetrating the BRL.

Airport Maintenance Facility

Airport maintenance activities are currently staged immediately south of the Tusayan Town Hall and Airport management office. The development plan calls for the construction of a dedicated maintenance facility to store and maintain Airport equipment in an area immediately south of the Aircraft Rescue and Firefighting (ARFF) facility. The building would be granted direct access to the airfield via the same roadway that serves the ARFF facility.

Self-Service Fuel Facility

The location for a fuel storage facility has been identified in an area adjacent to the proposed conventional hangar development. This location could provide self-service fueling capabilities, as it is planned adjacent to existing apron space that would allow for efficient movement of aircraft. The existing roadway immediately to the east would provide access for refueling tanker trucks needing to off-load fuel into the storage tank(s). As proposed, the fueling facility could accommodate a single storage tank for at least Avgas (100LL), with the capability of expanding to provide a storage tank for Jet A fuel.

Airport Housing

The alternatives analysis in the previous chapter detailed the on-site housing that currently exists at GCN. Due to limited housing options in the Town of Tusayan and surrounding area, the Airport currently accommodates 23 separate residential units located adjacent to the south side of the south entrance along Airport Road in an area comprising approximately 12 acres.

In order to maximize the use of existing property to benefit the Airport's revenue generating ability, the Master Plan Concept considers the relocation of the residential housing to a more remote location on the northwest side of the Airport that is comprised of approximately 18 acres. A new access road extending south from Long Jim Loop would be needed to provide access to this area.

Non-Aviation Development Potential

Exhibit 6A also details portions of property on the north and east sides of the Airport that could be utilized for non-aviation development. The location of these proposed non-aviation land uses consider access to existing roadway infrastructure and also account for land that is not readily granted access to the airfield system for aviation use. The area highlighted on the north side of the Airport consists of nearly 30 acres. Any future development in this area should be sensitive to the height of building infrastructure so as to not interfere with the Title 14 CFR Part 77 approach and transitional surfaces, threshold siting surfaces (TSS), and departure surfaces based on the approaches serving each end of Runway 3-21. A preliminary obstruction analysis was conducted in Chapter Five that examined future landside development potential in relationship to the approach and departure surfaces previously mentioned. The elevation of the terrain generally decreases moving from the Runway 21 threshold farther north, thus allowing for increased building height infrastructure that could support non-aviation development potential in this area.

The second highlighted area considered for non-aviation development is in the location of existing Airport housing. With the proposed relocation of the residential housing to the northwest quadrant of the Airport, approximately 12 acres of property could be converted to non-aviation revenue support with preferred access to existing and proposed roadway infrastructure in proximity to the terminal area. An additional three acres immediately west of this area could be secured for non-aviation development pending the ultimate relocation of the Airport management office and Tusayan Town Hall.

It should be noted that ADOT has not obtained specific approval from the FAA to use certain portions of airport property for non-aviation purposes as being proposed on the Master Plan Concept. Chapter Four provided a detailed description of the steps that must be taken in order to allow non-aviation uses on airport property should ADOT officials desire to do so in the future.

Landside Conclusion

The resultant landside concept represents a facility that fulfills aviation needs and preserves its long range viability that can be developed as demand dictates. It is designed to help guide the future growth and development of GCN. It should also be noted that the landside concept includes the acquisition of approximately 80 acres of land on the east side of the Airport between existing property and Highway 64. This potential property acquisition is included on the currently approved ALP and is being shown for planning purposes only.

Because the Master Plan is conceptual in nature, it allows for flexibility rather than dictating specific types and exact square footages of future land uses at the Airport. Flexibility will be very important to future landside development at the Airport, as activity may not occur as predicted. The landside plan provides airport stakeholders with a general guide to maintain the Airport as an important aviation facility serving the Grand Canyon National Park and regional area.

WATER SOURCE IMPROVEMENTS

The Airport's current source of potable water is supplied by Hydro-Resources. The water is initially sent to an underground storage tank associated with the existing terminal building. This tank has a storage capacity of 375,000 gallons. It is then transferred to two aboveground storage tanks located on the east side of the Airport near the south intersection of Airport Road and Highway 64. Each of these tanks has a storage capacity of 1.4 million gallons. In the past, the Airport has received water from Hydro-Resources two times per year.

Due to water scarcity in the region, Airport management has been sensitive to the amount of water being consumed at GCN in the past. Historically, the Airport had an operational self-contained rain water containment (catchment) system that was capable of capturing and storing over three million gallons of water. This system had to be eliminated, however, due to the location of the catchment basins within the RSA between the runway and parallel taxiway system. More recently, the Airport has been able to decrease the amount of water use through the implementation of various restriction and conservation measures. This has involved decreasing water usage by over 40 percent per year since 2011. In addition, ADOT engaged a private firm to conduct an evaluation of a potential water well site on Airport property in 2013.

With the potential improvements that are proposed in the Master Plan Concept through the long term planning period of this study, it is important that the Airport continue to be sensitive to water use. While the evaluation and determination of water source improvements falls outside the scope of this Master Plan, it is recommended that the Airport continue to analyze potential sources for improving the availability of water serving the facility in the future. These sources could include but are not limited to:

1) *Incorporate a water harvesting system into the design of existing and ultimate terminal facility improvements*. *In addition, the Airport could explore the future implementation of a water catchment system similar to what previously existed between the runway and parallel taxiway system.* Any future system should be located in an area that does not interfere with FAA-mandated design and safety standards.
2) *Continue to maintain and improve as appropriate the existing system in which water is received via pipeline from Hydro-Resources and stored in the water storage tanks on the east side of the Airport*. It should be noted that Hydro-Resources has previously offered the sale of their system to the Town of Tusayan. If such a sale were to occur in the future, the Airport would continue to coordinate with the provider to properly plan for the acquisition of water to its system and storage tanks.
3) *Drill a groundwater supply well on Airport property in a location that would yield a desired flow rate for the operation of the Airport*. As mentioned above, a study was conducted in 2013 that analyzed the potential locations and logistics involved with drilling a well on Airport property. The study concluded that the Airport requires a water supply of approximately 30 gallons per minute. Furthermore, the total estimated project cost range for drilling a groundwater supply well was determined to range from $1.9 to $3.9 million.

As discussed, a more extensive evaluation of potential water source improvements will need to be undertaken outside this Master Plan in order to determine the most effective way for the Airport to continue to be sensitive to water use and its effects on the surrounding area. This will need to include a technical and legal review of potential sources such those listed above. The capital program to be discussed in the next section of this chapter includes a project in the short term that would allow for this detailed study. An additional project in the short term is also recommended that would include the proper environmental documentation related to improving and enhancing the water supply for the Airport.

CAPITAL IMPROVEMENT PROGRAM

Now that the recommended Master Plan Concept has been developed and specific needs and improvements for the Airport have been established, the next step is to determine a realistic schedule for project implementation as well as the associated costs for the plan. This section will provide a description and overall cost for each project identified in the capital improvement program (CIP) and development schedule. The program has been evaluated from a variety of perspectives and represents a comparative analysis of basic budget factors, demand, and priority assignments.

The presentation of the capital program has been organized into two sections. First, the Airport's capital program needs are identified by various categories ranging from meeting safety and design standards to satisfying demand. Second, the development schedule and CIP cost estimates are presented in narrative and graphic form. The CIP has been developed following FAA guidelines for Master Plans and identifies those projects that are likely eligible for FAA grant funding. Capital improvement funding sources and financial projections for GCN are also identified later in this chapter.

AIRPORT DEVELOPMENT NEEDS

In an effort to identify capital needs at the Airport, this section provides analysis regarding the associated development needs of those projects included in the CIP. While some projects will be demand-based, others will be dictated by design standards, safety, or rehabilitation needs. Each development need is categorized according to this schedule. The applicable category (or categories) included are presented on **Exhibit 6B**. The proposed projects can be categorized as follows:

1) **Safety/Security (SS)** – these are capital needs considered necessary for operational safety and protection of aircraft and/or people and property on the ground near the Airport.

2) **Environmental (EN)** – these are capital needs which are identified to enable the Airport to operate in an environmentally acceptable manner or meet needs identified in the Environmental Overview outlined in Appendix B.

		Project Description	Development Category	Total Project Cost	FAA Eligible	ADOT Eligible*
		Short Term Program (Years 1-5)				
2018	1	Environmental Documentation (CatEx and/or EA) for Airside and Landside Improvements in the Short Term Program	EN	$500,000	$455,300	$44,700
	2	Design and Construct - Implement PAPI-4 and REILs on Runway 3	SS	$150,000	$136,590	$13,410
	3	Equipment Purchase - Lighted Xs (2) for Runway Construction Projects/Closures	SS	$75,000	$68,295	$6,705
	4	Equipment Purchase - Obtain Snow Plows (2) and Friction Trailer	SS/MN/EF	$750,000	$682,950	$67,050
	5	Design and Construct - Implement Perimeter Fencing in Helicopter Operating Areas	SS	$280,000	$254,968	$25,032
		2018 Total		**$1,755,000**	**$1,598,103**	**$156,897**
2019	6	Design and Construct - Implement No-Taxi Islands at Taxiways A/B and C Intersections (Include MITL)	SS	$122,000	$111,093	$10,907
	7	Conduct Drainage Master Plan	SS	$500,000	$455,300	$44,700
	8	Design - ADA Compliance/Renovations to Existing Terminal Building	SS/DM/OP	$400,000	$364,240	$35,760
	9	Conduct Water Source Analysis/Study	DM/EF/OP	$300,000	$273,180	$26,820
		2019 Total		**$1,322,000**	**$1,203,813**	**$118,187**
2020	10	Design - Airfield Culvert Relocations and Proper Grading	SS	$150,000	$136,590	$13,410
	11	Construct - ADA Compliance/Renovations to Existing Terminal Building	SS/DM/OP	$2,700,000	$2,458,620	$241,380
	12	Clear ROFA on West Side of Runway 3-21	SS	$230,000	$209,438	$20,562
	13	Conduct Environmental Assessment for Water Source Improvements	EN/DM	$800,000	$728,480	$71,520
		2020 Total		**$3,880,000**	**$3,533,128**	**$346,872**
2021	14	Construct - Airfield Culvert Relocations and Proper Grading	SS	$850,000	$774,010	$75,990
	15	Relocate Helicopter Parking Outside ROFA on North Side of Terminal Area	SS	$23,000	$20,944	$2,056
	16	Design - Runway 3-21 Shoulders/150' Width Correction and Pavement Rehabilitation/Reconstruction	SS/MN	$1,377,000	$1,253,896	$123,104
	17	Design - Airfield Perimeter Fencing Improvements	SS	$146,000	$132,948	$13,052
		2021 Total		**$2,396,000**	**$2,181,798**	**$214,202**
2022	18	Construct - 25' Runway Shoulders and Runway Width Correction	SS	$2,763,000	$2,515,988	$247,012
	19	Construct - Runway 3-21 Pavement Rehabilitation/Reconstruction	MN	$8,713,000	$7,934,058	$778,942
	20	Construct - Airfield Perimeter Fencing Improvements	SS	$1,215,000	$1,106,379	$108,621
	21	Replace Terminal Building Generator	MN	$500,000	$455,300	$44,700
	22	Remove/Relocate Portion of Perimeter Access Road on North Side of Runway 3-21 Outside RSA	SS	$43,000	$39,156	$3,844
		2022 Total		**$13,234,000**	**$12,050,880**	**$1,183,120**
		Short Term Program Total		**$22,587,000**	**$20,567,722**	**$2,019,278**
		Intermediate Term Program (Years 6-10)				
	1	Construct Blast Pads (Both Runway Ends)	SS	$798,000	$726,659	$71,341
	2	Replace Airfield Generator	MN	$200,000	$182,120	$17,880
	3	Rehabilitate Existing Terminal Roadways and Parking Lots	MN/EF	$560,000	$509,936	$50,064
	4	Environmental Assessment - Terminal Building Replacement	EN/DM	$500,000	$455,300	$44,700
	5	Equipment Purchase - ARFF Truck	SS	$1,300,000	$1,183,780	$116,220
	6	Equipment Purchase - Deicing Equipment to Service Larger Aircraft	SS/DM	$400,000	$364,240	$35,760
	7	Upgrade Perimeter Access Road on East and West Sides of Airfield	SS/EF	$2,863,000	$2,607,048	$255,952
	8	Construct Helipad Between ARFF Facility and Terminal Apron	DM/EF/OP	$81,000	$73,759	$7,241
	9	Construct Dedicated Airport Maintenance Facility	MN	$1,049,000	$0	$1,049,000
	10	Design New Replacement Terminal Building and Associated Infrastructure	DM/OP	$2,550,000	$1,275,000	$1,275,000
	11	Replace VASI-4 with PAPI-4 on Runway 21	MN	$98,000	$89,239	$8,761
	12	Construct New Replacement Terminal Building	DM/OP	$16,800,000	$8,400,000	$8,400,000
	13	Construct Associated Vehicle Access/Parking to Serve Replacement Terminal Building	DM	$3,600,000	$3,278,160	$321,840
	14	Relocate Airport Housing for Non-Aviation Development Potential	OP	**	**	**
	15	General Airfield Pavement Maintenance	MN	$500,000	$455,300	$44,700
		Intermediate Term Program Total		**$31,299,000**	**$19,600,540**	**$11,698,460**
		Long Term Program (Years 11-20)				
	1	Environmental Assessment - Runway 3-21 Extension	EN/DM	$1,000,000	$910,600	$89,400
	2	Redevelop Existing Terminal Area for Aviation Use (Site Preparation)	DM/OP	$250,000	$0	$250,000
	3	Implement Self-Service Fuel Facility/Fuel Farm	DM	$318,000	$0	$318,000
	4	Site Preparation for Runway 3-21 Extension (Clearing, Grading, Relocated Perimeter Access Road)	SS/DM	$8,198,000	$7,465,099	$732,901
	5	Extend Runway 3-21 1,001' Southwest and Associated Parallel Taxiway P	DM	$3,063,000	$2,789,168	$273,832
	6	Relocate Navigational Aids (Glideslope Antenna, PAPI-4, and REILs)	SS	$1,134,000	$1,032,620	$101,380
	7	General Airfield Pavement Maintenance	MN	$1,000,000	$910,600	$89,400
		Long Term Program Total		**$14,963,000**	**$13,108,087**	**$1,854,913**
		TOTAL PROGRAM COSTS		**$68,849,000**	**$53,276,349**	**$15,572,651**

Development Category - SS - Safety/Security DM - Demand EF - Efficiency EN - Environmental MN - Maintenance OP - Opportunity

*ADOT serves as the Airport Sponsor. **Coordination will be needed outside the Master Plan to further define the potential relocation of airport housing and associated costs in order to accommodate possible non-aviation development.

3) **Maintenance (MN)** – these are capital needs required to maintain the existing infrastructure at the Airport.

4) **Efficiency (EF)** – these are capital needs intended to optimize aircraft ground operations or passengers' use of the terminal area.

5) **Demand (DM)** – these are capital needs required to accommodate levels of aviation demand. The implementation of these projects should only occur when demand for these needs is verified.

6) **Opportunities (OP)** – these are capital needs intended to take advantage of opportunities afforded by the Airport setting. Typically, this will involve improvements to property intended for aviation or non-aviation related development.

AIRPORT CAPITAL IMPROVEMENT PROGRAM AND COST SUMMARIES

Now that the specific needs and improvements for GCN have been established, the next step is to determine a realistic schedule and the associated costs for implementing the recommended Master Plan Concept. The capital program considers the interrelationships among the projects in order to determine an appropriate sequence of projects while remaining within reasonable fiscal constraints.

This section will examine the overall cost of each item in the capital program. The CIP, programmed by years, has been developed to cover the first five years of the plan. The remaining projects are grouped into intermediate (years 6-10) and long (years 11-20) term planning horizons. More detailed information is provided for the five-year horizon, with less detail provided for the longer planning periods. By utilizing planning horizons instead of specific years for intermediate and long term development, ADOT will have greater flexibility to adjust capital needs as demand dictates. **Table 6C** summarizes the key milestones for each of the three planning horizons.

A key aspect of this planning document is the use of demand-based planning milestones. The short term planning horizon contains items of highest need and/or priority. As short term horizon activity levels are reached, it will then be time to program for the intermediate term based upon the next activity milestones. Similarly, when the intermediate term milestones are reached, it will be time to program for the long term activity milestones.

Many development items included in the recommended concept will need to follow demand indicators which essentially establish triggers for key improvements. For example, the alternatives analysis and Master Plan Concept includes an ultimate replacement terminal building. Growth in passenger enplanements is the trigger for this project. The proposed runway extension outlined in the Master Plan Concept also follows similar triggers related to the increased demand for commercial service aircraft that would require additional runway length. If growth slows or does not occur as projected, these projects can be delayed. As a result, the capital expenditures will be undertaken as needed, which leads to a responsible

use of capital assets. Some development items do not depend on demand, such as pavement maintenance. These types of projects typically are associated with day-to-day operations and should be monitored and identified by Airport management.

TABLE 6C
Planning Horizon Activity Levels
Grand Canyon National Park Airport

	Base Year	Short Term	Intermediate Term	Long Term
ENPLANED PASSENGERS				
Air Tour	329,128	396,000	442,000	540,000
Airline/Air Charter	-	42,000	67,000	125,000
TOTAL ENPLANED PASSENGERS	**329,128**	**438,000**	**509,000**	**665,000**
BASED AIRCRAFT				
Single Engine Piston	2	2	3	5
Multi-Engine Piston	0	0	0	0
Turboprop	6	7	8	10
Jet	0	0	1	1
Helicopter	29	32	34	38
TOTAL BASED AIRCRAFT	**37**	**41**	**46**	**54**
ANNUAL OPERATIONS				
Itinerant				
Airline/Air Charter	-	2,200	2,400	3,600
Air Tour	91,488	105,600	118,200	143,600
General Aviation	2,731	3,030	3,400	4,000
Air Taxi	9,402	10,850	12,150	14,750
Military	604	600	600	600
Total Itinerant	**104,225**	**122,280**	**136,750**	**166,550**
Local				
General Aviation	1,181	1,210	1,235	1,285
Military	553	550	550	550
Total Local	**1,734**	**1,760**	**1,785**	**1,835**
TOTAL OPERATIONS	**105,959**	**124,040**	**138,535**	**168,385**

Because of economic realities, few airports are constructing hangars on their own, instead relying on private developers. In some cases, private developers can keep construction costs lower, which in turn lowers the monthly lease rates necessary to amortize a loan. To the greatest extent possible, private development of all hangar types should be supported and promoted by the airport sponsor. The CIP for the Airport assumes that all future hangars would be constructed through public/private partnerships. This assumption does not preclude the possibility of the Airport constructing new hangars.

The airport sponsor's responsibility related to new hangars can be to provide public access taxiways, typically in conjunction with FAA and/or state development grants. These taxiways are then able to be utilized by hangar tenants for aircraft access to the runway/taxiway system.

Not all projects identified are necessary to meet projected demand. Other projects are necessary to enhance the safety of GCN, maintain existing infrastructure, or meet FAA design standards. These projects need to be programmed in a timely manner regardless of changes in demand indicators.

As a Master Plan is a conceptual document, implementation of the capital projects should only be undertaken after further refinement of their design and costs through architectural or engineering analyses. Moreover, some projects may require additional infrastructure improvements (i.e., drainage improvements, extension of utilities, etc.) that may increase the estimated cost of the project or increase the timeline for completion.

Once a list of necessary projects was identified and refined, project-specific cost estimates were prepared. The cost estimates also include design, construction administration, and contingencies that may arise on the project. Capital costs presented here should be viewed only as "order-of-magnitude" estimates subject to further refinement during design. Nevertheless, they are considered sufficient for planning purposes. Cost estimates for each of the development projects in the CIP are in current (2017) dollars. Adjustments will need to be applied over time as construction costs or capital equipment costs change.

Exhibit 6B presents the proposed 20-year CIP for GCN. An estimate of FAA and ADOT funding eligibility has been included, although actual funding is not guaranteed. For those projects that would be eligible for federal funding, AIP reauthorization provides for 91.06 percent of the total project cost at GCN. The remaining amount (8.94 percent) would be the responsibility of the airport sponsor (ADOT). This eligibility breakdown is based upon the airport's classification in addition to the amount of public land within the State of Arizona.

As detailed in the CIP, the majority of projects listed are eligible for federal funding assistance. Obviously, demand and justification for these projects must be provided prior to a grant being issued by either the FAA and/or ADOT. **Exhibits 6C** and **6D** graphically depict the short, intermediate, and long term development staging by overlaying each project onto the aerial photograph of the Airport.

The FAA utilizes a national priority rating system to help objectively evaluate potential airport projects. Projects are weighted toward safety, infrastructure preservation, meeting design standards, and capacity enhancement. The FAA will participate in the highest priority projects before considering lower priority projects, even if a lower priority project is considered a more urgent need by the local sponsor. Nonetheless, the project should remain a priority for the Airport and funding support should continue to be requested in subsequent years.

Some projects identified in the CIP will require environmental documentation. The level of documentation necessary for each project must be determined in consultation with the FAA and ADOT. There are

three major levels of environmental review to be considered under the *National Environmental Policy Act* (NEPA) that include categorical exclusions (CatEx), Environmental Assessments (EA), and Environmental Impact Statements (EIS). Each level requires more time to complete and more detailed information. Guidance on what level of documentation is required for a specific project is provided in FAA Order 1050.1F, *Environmental Impacts: Policies and Procedures*. The Environmental Overview presented in Appendix B addresses NEPA and provides an evaluation of various environmental categories for GCN. The level of environmental documentation that could be required for future projects in the CIP is also addressed in Appendix B.

The following sections will describe in greater detail the projects identified for the Airport over the next 20 years. The projects are grouped based upon a detailed evaluation of existing and projected demand, safety, rehabilitation needs, and local priority. While the CIP identifies the priority ranking of the projects, the list should be evaluated and revised on a regular basis. It is also important to note that certain projects, while listed separately for purposes of evaluation in this study, could be combined with other projects during time of construction/ implementation.

Short Term Program

The short term projects are those anticipated to be needed in years one through five of the 20-year CIP. The list of projects is further divided into yearly timeframes and are prioritized based on the needs of GCN. Projects related to safety and preservation generally have the highest priority. The short term program considers 22 projects for the planning period as presented on **Exhibit 6B** and depicted on **Exhibit 6C**. The following provides a detailed breakdown of each project.

Project #1: Environmental Documentation (CatEx or EA) for Airside and Landside Improvements in the Short Term Program

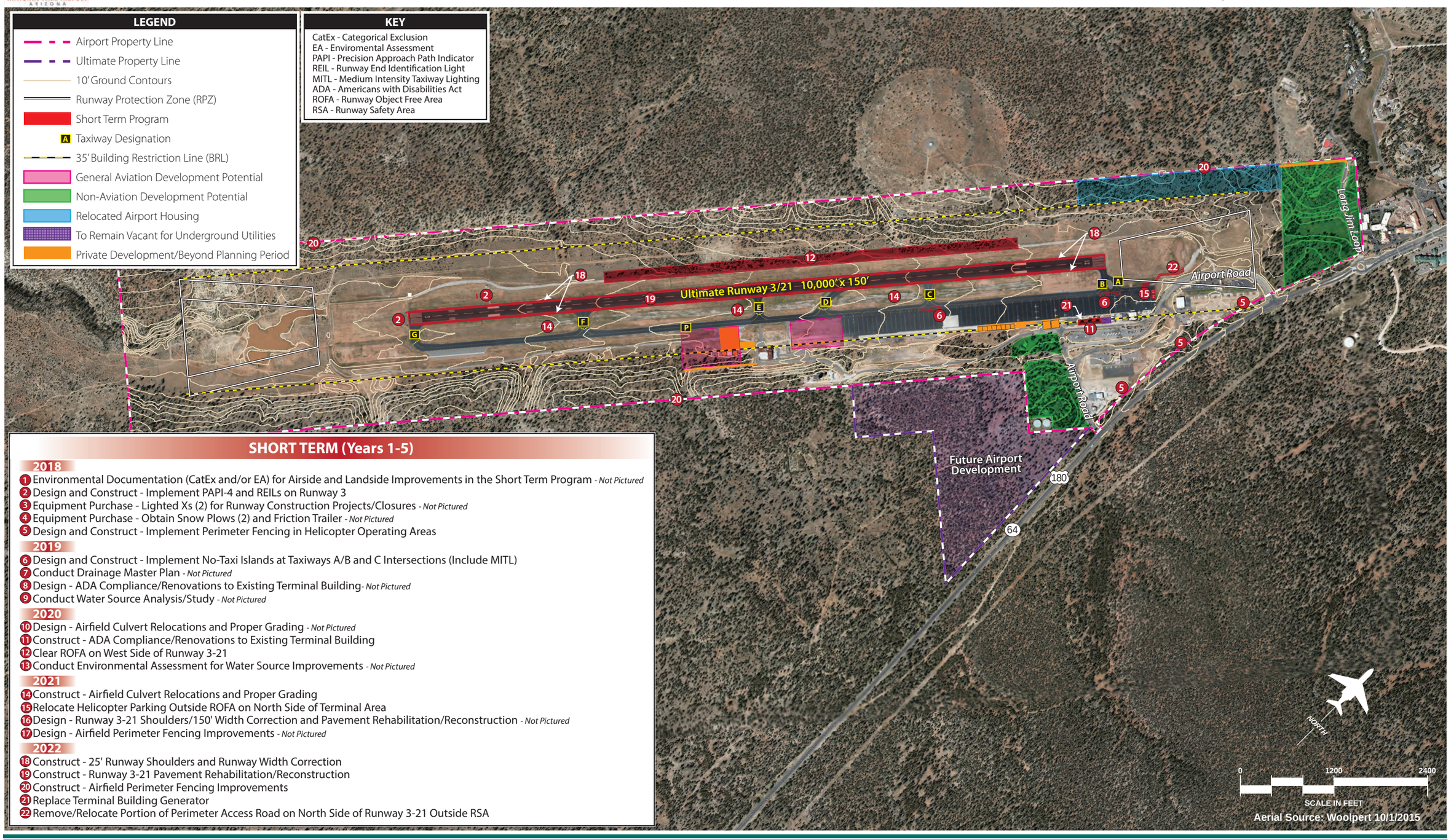
Description: This project will provide the necessary environmental reviews needed for several projects outlined in the short term program. These environmental reviews, whether a CatEx or EA, would likely be programmed separately and in conjunction with a particular project at least one year in advance of actual construction and/or implementation.
Funding Eligibility: FAA – 91.06 percent / ADOT – 8.94 percent.

Project #2: Design and Construct – Implement PAPI-4 and REILs on Runway 3

Description: In order to enhance visual approach capabilities at the Airport, a PAPI-4 system and REILs are called for on Runway 3. Given the nature of this project, the design and construction of such facilities is programmed in the same year.
Funding Eligibility: FAA – 91.06 percent / ADOT – 8.94 percent.

Project #3: Equipment Purchase – Lighted Xs (2) for Runway Construction Projects/Closures

Description: This equipment purchase involves the acquisition of two lighted Xs that can increase safety and vigilance of the runway environment during construction projects and/or airport closures.
Funding Eligibility: FAA – 91.06 percent / ADOT – 8.94 percent.



SHORT TERM (Years 1-5)

2018

1. Environmental Documentation (CatEx and/or EA) for Airside and Landside Improvements in the Short Term Program - *Not Pictured*
2. Design and Construct - Implement PAPI-4 and REILs on Runway 3
3. Equipment Purchase - Lighted Xs (2) for Runway Construction Projects/Closures - *Not Pictured*
4. Equipment Purchase - Obtain Snow Plows (2) and Friction Trailer - *Not Pictured*
5. Design and Construct - Implement Perimeter Fencing in Helicopter Operating Areas

2019

6. Design and Construct - Implement No-Taxi Islands at Taxiways A/B and C Intersections (Include MITL)
7. Conduct Drainage Master Plan - *Not Pictured*
8. Design - ADA Compliance/Renovations to Existing Terminal Building- *Not Pictured*
9. Conduct Water Source Analysis/Study - *Not Pictured*

2020

10. Design - Airfield Culvert Relocations and Proper Grading - *Not Pictured*
11. Construct - ADA Compliance/Renovations to Existing Terminal Building
12. Clear ROFA on West Side of Runway 3-21
13. Conduct Environmental Assessment for Water Source Improvements - *Not Pictured*

2021

14. Construct - Airfield Culvert Relocations and Proper Grading
15. Relocate Helicopter Parking Outside ROFA on North Side of Terminal Area
16. Design - Runway 3-21 Shoulders/150' Width Correction and Pavement Rehabilitation/Reconstruction - *Not Pictured*
17. Design - Airfield Perimeter Fencing Improvements - *Not Pictured*

2022

18. Construct - 25' Runway Shoulders and Runway Width Correction
19. Construct - Runway 3-21 Pavement Rehabilitation/Reconstruction
20. Construct - Airfield Perimeter Fencing Improvements
21. Replace Terminal Building Generator
22. Remove/Relocate Portion of Perimeter Access Road on North Side of Runway 3-21 Outside RSA

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Project #4: Equipment Purchase – Obtain Snow Plows (2) and Friction Trailer

Description: This equipment purchase involves two new snow plows and a pull-behind friction measurement trailer for runway friction testing.
Funding Eligibility: FAA – 91.06 percent / ADOT – 8.94 percent.

Project #5: Design and Construct – Implement Perimeter Fencing in Helicopter Operating Areas

Description: In order to increase security as well as enhance wildlife control measures, approximately 8,000 linear feet of perimeter fencing is to be constructed in areas adjacent to the helicopter tour operators on the northeast side of the Airport.
Funding Eligibility: FAA – 91.06 percent / ADOT – 8.94 percent.

Project #6: Design and Construct – Implement No-Taxi Islands at Taxiways A/B and C Intersections (Include MITL)

Description: In an effort to improve airfield safety and geometry, No Taxi Islands are called for to prevent direct access from the aircraft parking apron to Runway 3-21. The implementation of MITL is also considered in these areas.
Funding Eligibility: FAA – 91.06 percent / ADOT – 8.94 percent.

Project #7: Conduct Drainage Master Plan

Description: This study will aid in the design of a plan for the Airport to improve airfield drainage, especially in the areas adjacent to the runway and taxiway system. It can also take into account potential collection sources and locations for water harvesting.
Funding Eligibility: FAA – 91.06 percent / ADOT – 8.94 percent.

Project #8: Design – ADA Compliance/Renovations to Existing Terminal Building

Description: The necessary design associated with short term improvements to the existing terminal building detailed earlier in this study will be undertaken.
Funding Eligibility: FAA – 91.06 percent / ADOT – 8.94 percent.

Project #9: Conduct Water Source Analysis/Study

Description: As detailed earlier in this chapter, the Airport should conduct a detailed study that further analyzes potential water source improvements for the Airport. It is recommended that this study occur in the short term in order to appropriately plan the necessary environmental clearances that would need to occur prior to actual implementation in the future.
Funding Eligibility: FAA – 91.06 percent / ADOT – 8.94 percent.

Project #10: Design: Airfield Culvert Relocations and Proper Grading

Description: Based on the drainage master plan conducted in the prior year, this project will provide the necessary design reviews needed to improve airfield drainage that includes the relocation of culverts outside the RSA and proper grading of the airfield.
Funding Eligibility: FAA – 91.06 percent / ADOT – 8.94 percent.

Project #11: Construct – ADA Compliance/Renovations to Existing Terminal Building

Description: The final phase of the existing terminal building renovations will include the actual construction associated with improvements to the facility. These include updating the building to IBC and ADA compliance standards, enhancing the efficiency and capacity of the facility, meeting standards for Transportation Security Administration (TSA) security screening, improving passenger holding areas and baggage screening/handling, and implementing environmentally sustainable measures.
Funding Eligibility: FAA – 91.06 percent / ADOT – 8.94 percent

Project #12: Clear ROFA on West Side of Runway 3-21

Description: The implementation of safety area improvements to the ROFA includes the clearing of vegetation on the west side of Runway 3-21, particularly in areas adjacent to the middle third of the runway system.
Funding Eligibility: FAA – 91.06 percent / ADOT – 8.94 percent.

Project #13: Conduct Environmental Assessment for Water Source Improvements

Description: Based on the findings of the water source study conducted the year prior, environmental reviews will be conducted that analyze the impacts that potential improvements to water utilization at the Airport will have on the surrounding area. It can be assumed that an EA will be needed for environmental documentation.
Funding Eligibility: FAA – 91.06 percent / ADOT – 8.94 percent.

Project #14: Construct – Airfield Culvert Relocations and Proper Grading

Description: The construction of airfield culvert relocations and proper grading of the safety areas will occur the year following the design for this project.
Funding Eligibility: FAA – 91.06 percent / ADOT – 8.94 percent.

Project #15: Relocate Helicopter Parking Outside ROFA on North Side of Terminal Area

Description: Continued improvements to meet ROFA standards on Runway 3-21 include the removal of two helicopter parking pads adjacent to the north side of the terminal area. The plan considers relocating them on existing apron space outside the ROFA.
Funding Eligibility: FAA – 91.06 percent / ADOT – 8.94 percent.

Project #16: Design – Runway 3-21 Shoulders/150' Width Correction and Pavement Rehabilitation/Reconstruction

Description: Another safety enhancement planned for the runway includes constructing paved shoulders on each side of the runway and correcting the width of the runway to 150 feet as published. The design of these projects is considered in the CIP item. Furthermore, the design of pavement rehabilitation and/or reconstruction associated with the runway is programmed.
Funding Eligibility: FAA – 91.06 percent / ADOT – 8.94 percent.

Project #17: Design – Airfield Perimeter Fencing Improvements

Description: This project includes the design of perimeter fencing and gates to be installed on the Airport.
Funding Eligibility: FAA – 91.06 percent / ADOT – 8.94 percent.

Project #18: Construct – 25' Runway Shoulders and Runway Width Correction

Description: Construct 25-foot paved shoulders on Runway 3-21 and expand the width of runway pavement to 150 feet.
Funding Eligibility: FAA – 91.06 percent / ADOT – 8.94 percent.

Project #19: Construct – Runway 3-21 Pavement Rehabilitation/Reconstruction

Description: Rehabilitate and/or reconstruct the runway to continue to support demand for the full array of commercial service, general aviation, and military aircraft that utilize the Airport. Although separate from the previous project detailed, it is recommended that this project be undertaken with the implementation of paved shoulders and runway width correction so as to reduce the amount of time the runway would be closed for maintenance.
Funding Eligibility: FAA – 91.06 percent / ADOT – 8.94 percent.

Project #20: Construct – Airfield Perimeter Fencing Improvements

Description: To follow up the design from the year before, the installation of new perimeter fencing and gates along the exterior of the Airport is to be conducted. This will help protect Airport property interests and enhance overall security while also better controlling wildlife concerns.
Funding Eligibility: FAA – 91.06 percent / ADOT – 8.94 percent.

Project #21: Replace Terminal Building Generator

Description: This project calls for continued enhancements to the existing terminal building in the form of a new generator.
Funding Eligibility: FAA – 91.06 percent / ADOT – 8.94 percent.

Project #22: Remove/Relocate Portion of Perimeter Access Road on North Side of Runway 3-21 Outside RSA

Description: The final project programmed in the short term includes another safety area improvement to the runway system. It includes the removal and relocation of a portion of the perimeter access road that penetrates the RSA beyond the north end of Runway 3-21.
Funding Eligibility: FAA – 91.06 percent / ADOT – 8.94 percent.

Short Term Program Summary

The short term CIP includes projects that enhance the overall safety and maintenance of the airfield while also implementing landside improvements to the existing terminal building. The total investment necessary for the short term CIP is approximately $22.59 million as detailed on **Exhibit 6B**. Of this total,

approximately $16 million is related to improving the existing terminal building and maintaining/improving the pavement on Runway 3-21. Overall, approximately $20.57 million is eligible for federal funding assistance. The remaining $2.02 million is to be provided by ADOT.

Intermediate Term Program

The intermediate term projects are those that are anticipated to be necessary in years six through 10 of the Master Plan. These projects are not tied to specific years for implementation; instead, they have been prioritized so that ADOT has the flexibility to determine when they need to be pursued based on current conditions. It is not unusual for certain projects to be delayed or advanced based on changing conditions, such as funding availability or changes in the aviation industry. This planning horizon includes 15 projects for the five-year timeframe as listed on **Exhibit 6B** and depicted on **Exhibit 6D**. The following section includes a description of each project.

Project #1: Construct Blast Pads (Both Runway Ends)

Description: This project involves constructing blast pads serving Runway 3-21 to meet RDC C-III design standards. In order to meet this standard, the blast pads should be dimensioned as 200 feet long by 200 feet wide. As previously discussed, the blast pad serving Runway 3 should be programmed on the existing runway environment. In the event that the runway is ultimately extended, a new blast pad would be considered beyond the end of the extension.
Funding Eligibility: FAA – 91.06 percent / ADOT – 8.94 percent.

Project #2: Replace Airfield Generator

Description: The replacement of the airfield generator is programmed during this time. This equipment is situated in the electrical vault located north of the ARFF facility.
Funding Eligibility: FAA – 91.06 percent / ADOT – 8.94 percent.

Project #3: Rehabilitate Existing Terminal Roadways and Parking Lots

Description: The Airport has recently begun rehabilitation of the parking lot associated with the existing terminal building. In a continuing effort to maintain landside pavements, the rehabilitation of parking lots and access roads serving the terminal area and other areas of the Airport is considered in the intermediate term. This project could be divided into multiple projects depending on the degree to which pavement rehabilitation is needed. These projects would be eligible for FAA funding as long as the Airport were to use its entitlement funds (detailed later in this chapter) to help fund them.
Funding Eligibility: FAA – 91.06 percent / ADOT – 8.94 percent.

Project #4: Environmental Assessment – Terminal Building Replacement

Description: The potential construction of a replacement terminal building as detailed in the Master Plan Concept will require multiple phases, with the first being environmental documentation related to the construction of the new facility. It is important to note that this project, along with other subsequent projects associated with the new facility, will be dependent on justification (demand) and further coordination with the FAA.
Funding Eligibility: FAA – 91.06 percent / ADOT – 8.94 percent.

LEGEND

- Airport Property Line
- Ultimate Property Line
- 10' Ground Contours
- Runway Protection Zone (RPZ)
- Intermediate Term Program
- Long Term Program
- A Taxiway Designation
- 35' Building Restriction Line (BRL)
- General Aviation Development Potential
- Non-Aviation Development Potential
- To Remain Vacant for Underground Utilities
- Private Development/Beyond Planning Period

INTERMEDIATE TERM (Years 6-10)

1. Construct Blast Pads (Both Runway Ends)
2. Replace Airfield Generator
3. Rehabilitate Existing Terminal Roadways and Parking Lots
4. Environmental Assessment - Terminal Building Replacement - *Not Pictured*
5. Equipment Purchase - ARFF Truck - *Not Pictured*
6. Equipment Purchase - Deicing Equipment to Service Larger Aircraft - *Not Pictured*
7. Upgrade Perimeter Access Road on East and West Sides of Airfield
8. Construct Helipad Between ARFF Facility and Terminal Apron
9. Construct Dedicated Airport Maintenance Facility
10. Design New Replacement Terminal Building and Associated Infrastructure - *Not Pictured*
11. Replace VASI-4 with PAPI-4 on Runway 21
12. Construct New Replacement Terminal Building
13. Construct Associated Vehicle Access/Parking to Serve Replacement Terminal Building
14. Relocate Airport Housing for Non-Aviation Development Potential*
15. General Airfield Pavement Maintenance - *Not Pictured*

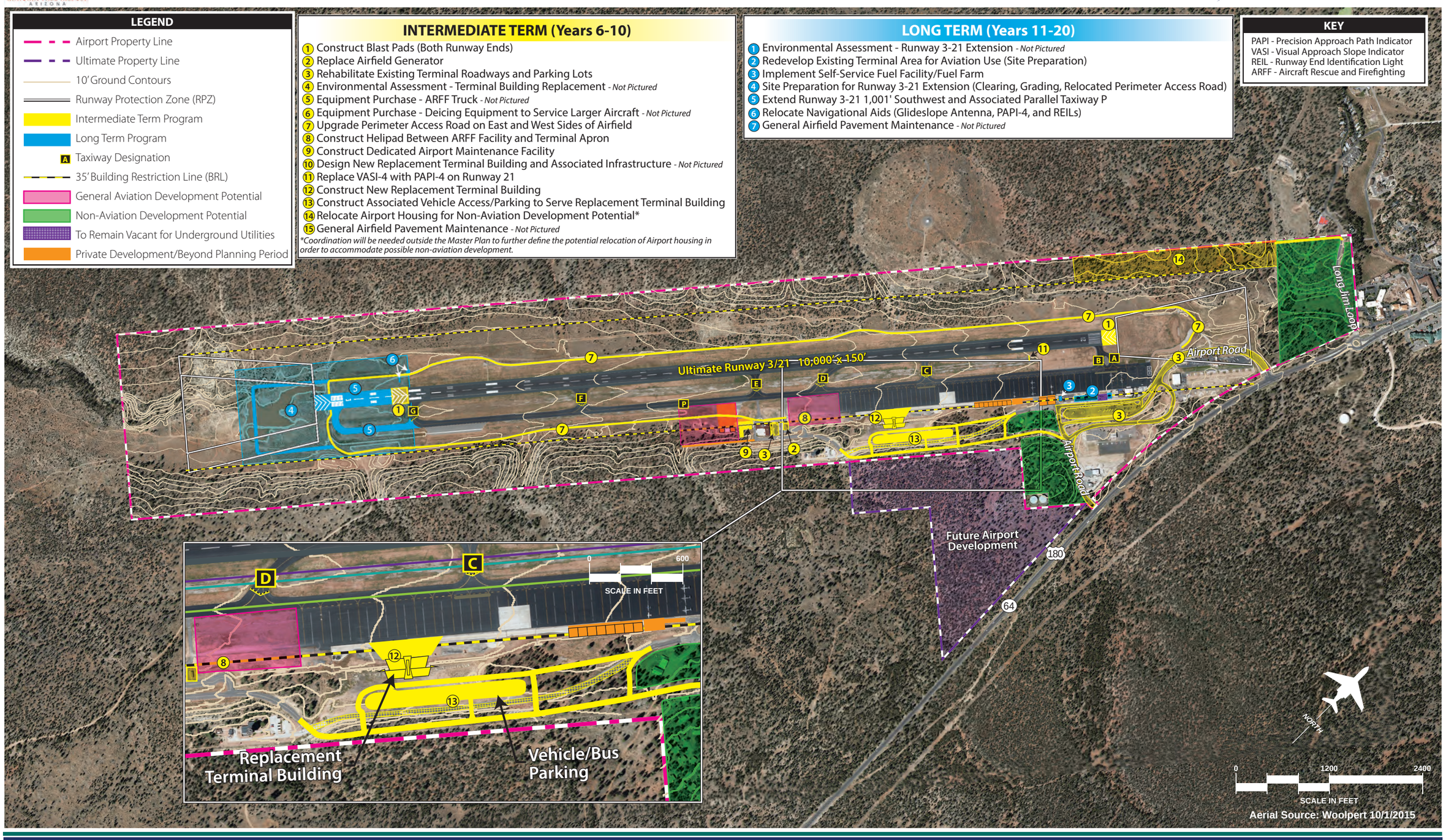
**Coordination will be needed outside the Master Plan to further define the potential relocation of Airport housing in order to accommodate possible non-aviation development.*

LONG TERM (Years 11-20)

1. Environmental Assessment - Runway 3-21 Extension - *Not Pictured*
2. Redevelop Existing Terminal Area for Aviation Use (Site Preparation)
3. Implement Self-Service Fuel Facility/Fuel Farm
4. Site Preparation for Runway 3-21 Extension (Clearing, Grading, Relocated Perimeter Access Road)
5. Extend Runway 3-21 1,001' Southwest and Associated Parallel Taxiway P
6. Relocate Navigational Aids (Glideslope Antenna, PAPI-4, and REILs)
7. General Airfield Pavement Maintenance - *Not Pictured*

KEY

PAPI - Precision Approach Path Indicator
VASI - Visual Approach Slope Indicator
REIL - Runway End Identification Light
ARFF - Aircraft Rescue and Firefighting



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Project #5: Equipment Purchase – ARFF Truck

Description: A new ARFF truck is programmed to replace an existing ARFF truck that will be over 15 years old by the intermediate term program.
Funding Eligibility: FAA – 91.06 percent / ADOT – 8.94 percent.

Project #6: Equipment Purchase – Deicing Equipment to Service Larger Aircraft

Description: This equipment purchase involves the acquisition of deicing equipment to serve larger aircraft that could be operating at the Airport on a more frequent basis by this planning horizon.
Funding Eligibility: FAA – 91.06 percent / ADOT – 8.94 percent.

Project #7: Upgrade Perimeter Access Road and East and West Sides of Airfield

Description: This involves upgrading approximately 19,000 feet of internal perimeter access road that serves the airfield. The upgrades include widening and paving the road to satisfy various demands placed on it related to airfield inspections, perimeter checks, and accessing navigational aids.
Funding Eligibility: FAA – 91.06 percent / ADOT – 8.94 percent.

Project #8: Construct Helipad Between ARFF Facility and Terminal Apron

Description: A helipad is programmed at this time in an area designated for general aviation development between the existing ARFF facility and ultimate replacement terminal building. This helipad could support various civilian helicopter operations, including an air medical transport activities.
Funding Eligibility: FAA – 91.06 percent / ADOT – 8.94 percent.

Project #9: Construct Dedicated Airport Maintenance Facility

Description: The construction of a maintenance facility is planned south of the ARFF facility. This would improve the efficiency of airfield operations and maintenance activities in being able to locate these activities in close proximity to one another. This project would be a low priority item for FAA funding, so it is programmed for ADOT eligibility only.
Funding Eligibility: FAA – 0 percent / ADOT – 100 percent.

Project #10: Design New Replacement Terminal Building and Associated Infrastructure

Description: The design of the new replacement terminal building and associated vehicle access and parking would occur after the proper environmental analysis has been conducted and approved. Funding for the design and construction of the replacement terminal building is programmed at a 50 percent split from the FAA and ADOT.
Funding Eligibility: FAA – 50 percent / ADOT – 50 percent.

Project #11: Replace VASI-4 with PAPI-4 on Runway 21

Description: Replace the existing VASI-4 serving Runway 21 with a PAPI-4, similar to what is being proposed on Runway 3 in the short term program. As previously discussed, this project was recently implemented at the Airport.
Funding Eligibility: FAA – 91.06 percent / ADOT – 8.94 percent.

Project #12: Construct New Replacement Terminal Building

Description: The final phase of the replacement terminal building will include the actual construction of the facility and associated infrastructure based on the course of action determined in the environmental and design phases. The programmed CIP cost considers a facility that encompasses approximately 30,000 square feet and contains sustainability initiatives as detailed in the Sustainability Management Plan section of this study.
Funding Eligibility: FAA – 50 percent / ADOT – 50 percent.

Project #13: Construct Associated Vehicle Access/Parking to Serve Replacement Terminal Building

Description: The construction of access roads and parking lots to support the replacement terminal building would occur at the same time the terminal building is being constructed. This would involve a new roadway network extending south from the existing terminal area that would provide access to parking infrastructure for vehicles, buses, and other potential vehicle support operations.
Funding Eligibility: FAA – 91.06 percent / ADOT – 8.94 percent.

Project #14: Relocate Airport Housing for Non-Aviation Development Potential

Description: This project entails the relocation of existing residential housing from the east side of the Airport to the northwest quadrant of the Airport. In doing so, approximately 12 acres of property could be repurposed for non-aviation development potential.
Funding Eligibility: Coordination will be needed outside the Master Plan to define the necessary implementation and phasing of relocating the residential housing and associated costs. As such, an estimated project cost is not included at this time. It is important to note, however, that costs associated with the relocation of residential housing would likely not be eligible for FAA funding since the relocation is associated with non-aviation development potential occurring on the Airport.

Project #15: General Airfield Pavement Maintenance

Description: This includes a line item in the CIP that allocates a certain amount of funding for the general maintenance of various pavements not specifically identified by project in the CIP and could include crack sealing and other routine maintenance. While listed as one project here, multiple projects over the course of the intermediate term program could be identified for pavement maintenance.
Funding Eligibility: FAA – 91.06 percent / ADOT – 8.94 percent.

Intermediate Term Program Summary

The total costs associated with the intermediate term program are estimated at $31.30 million as presented on **Exhibit 6B**; however, this does not include the costs associated with the potential relocation of Airport housing. Of this total, approximately $19.60 million is programmed as being eligible for federal funding, and the ADOT share is projected at $11.70 million. Over half the intermediate term program costs are associated with environmental documentation, design, and construction of the replacement terminal building.

Long Term Program

The long term planning horizon considers seven projects for the 10-year period that mainly involve the potential extension of Runway 3-21. The projects and their associated costs are listed on **Exhibit 6B** and graphically depicted on **Exhibit 6D** as appropriate. Airport management and ADOT should assess the need and timing for these projects based on actual demand and growth at GCN.

Project #1: Environmental Assessment – Runway 3-21 Extension

Description: The potential extension of Runway 3-21 will involve multiple phases, with the first being environmental documentation related to the 1,001-foot extension beyond the southwest end of Runway 3-21. This environmental documentation would require at least an EA. Similar to the replacement terminal building, this project will be dependent on future demand associated with commercial service aircraft needs.
Funding Eligibility: FAA – 91.06 percent / ADOT – 8.94 percent.

Project #2: Redevelop Existing Terminal Area for Aviation Use (Site Preparation)

Description: The relocation of the terminal building will allow for the existing space to be utilized for other aviation purposes. The redevelopment of this area could involve site preparations associated with repurposing the existing terminal facility or razing it to make space for specific aviation user demands.
Funding Eligibility: FAA – 0 percent / ADOT – 100 percent.

Project #3: Implement Self-Service Fuel Facility/Fuel Farm

Description: Construct a fuel facility that can accommodate self-service fueling operations. This project is programmed to provide Avgas (100LL) and Jet A fueling capabilities, but could be scaled back to just provide Avgas fuel initially. Since this is considered a revenue-generating project, it is not eligible for FAA funding.
Funding Eligibility: FAA – 0 percent / ADOT – 100 percent.

Project #4: Site Preparation for Runway 3-21 Extension (Clearing, Grading, Relocated Perimeter Access Road)

Description: The next phase of the proposed runway extension involves clearing and grading the area associated with the extension in order to meet safety design standards. The project would include removing Rain Tank and relocating the perimeter access road.
Funding Eligibility: FAA – 91.06 percent / ADOT – 8.94 percent.

Project #5: Extend Runway 3-21 1,001' Southwest and Associated Parallel Taxiway P

Description: Based on further justification and coordination with the FAA, the extension of Runway 3-21 is planned. This also includes the extension of parallel Taxiway P and implementation of a new blast pad.
Funding Eligibility: FAA – 91.06 percent / ADOT – 8.94 percent.

Project #6: Relocate Navigational Aids (Glideslope Antenna, PAPI-4, REILs)

Description: The runway extension would require the relocation of the glideslope antenna associated with the precision ILS approach serving Runway 3. The relocation of the PAPI-4 and REILs programmed in the short term CIP would also be relocated to the new runway threshold.
Funding Eligibility: FAA – 91.06 percent / ADOT – 8.94 percent.

Project #7: General Airfield Pavement Maintenance

Description: Similar to the intermediate term program, a line item in the long term CIP allocates a certain amount of funding for the general maintenance of various pavements not specifically identified by project in the CIP and could include crack sealing and other routine maintenance. While listed as one project here, multiple projects over the course of the long term program could be identified for pavement maintenance.
Funding Eligibility: FAA – 91.06 percent / ADOT – 8.94 percent.

Long Term Program Summary

As detailed on **Exhibit 6B**, the total costs associated with the long term program are estimated at $14.96 million. Of this total, approximately $13.11 million could be eligible for federal funding. ADOT's matching share is projected at $1.85 million.

Capital Improvement Program Summary

The list of projects needed to accomplish the vision for GCN has been prioritized and cost estimates have been developed. Projects considered for the short term planning horizon (years 1-5) have been divided into yearly increments. Projects considered for the intermediate (years 6-10) and long term (years 11-20) have been prioritized and grouped together. The grouping of projects is necessary to provide the needed flexibility for the Airport to make adjustments as necessary. In addition, on an annual basis, the Airport, FAA, and ADOT-MPD – Aeronautics Group assemble and review a five-year CIP. Therefore, the list of projects and the prioritization of the projects can and likely will change in the future.

The total CIP proposes approximately $68.85 million in development needs. Of this total, approximately $53.28 million could be eligible for federal funding assistance. The ADOT funding estimate for the proposed CIP is approximately $15.57 million. Over time, the sequence of projects may change due to availability of funds or changing priorities.

FINANCIAL PLAN

This section presents financial projections for GCN based on the CIP presented in **Exhibit 6B** and the aviation activity forecasts presented in Chapter 2. The Airport's Fiscal Year (FY) ends June 30. Financial projections were developed for three planning periods: Phase 1 (years 1-5 or FY 2018 through FY 2022),

Phase 2 (years 6-10 or FY 2023 through FY 2027), and Phase 3 (years 11-20 or FY 2028 through FY 2037). Financial projections are based on historical FY 2016 data and FY 2017 historical results through February 28, 2017 provided by the Arizona Department of Transportation (ADOT).

AIRPORT'S FINANCIAL STRUCTURE

The Airport is owned and operated by ADOT and accounts for its operation as part of the State Aviation Fund. The State Aviation Fund is appropriated by the legislature and receives funds from aviation gasoline taxes, sale of abandoned or seized aircraft, flight property taxes, and the operation of GCN. The State Aviation Fund is described in greater detail later in this chapter. GCN uses the accrual basis of accounting; revenues are recognized when earned and expenses are recognized when a liability is incurred, regardless of the timing of the related cash flows.

CAPITAL IMPROVEMENT PROGRAM

All airports receiving federal AIP funding are required to maintain a current CIP with the FAA, which identifies projects to be undertaken at an airport over the next five-year period. The CIP further estimates the order of implementation as well as total project costs and funding sources. **Table 6D** presents cost estimates based on a planning level of detail for Phase 1, which is the required five-year plan, as well as Phase 2 and Phase 3.

While accurate for master planning purposes, actual project costs will likely vary from these planning estimates once project design and engineering estimates are developed. The cost estimates presented in the table are in 2017 dollars and also include contingencies, design costs, and construction management costs. Beginning with Phase 2, project costs are inflated at 2.7 percent annually, which reflects the most recent five-year average of *Engineering News Record*'s Construction Cost Index. As shown in the table, the CIP is estimated to cost approximately $68.8 million in 2017 dollars and approximately $84.0 million in inflated dollars.

Potential funding sources for any proposed improvements at GCN can be found at a variety of agencies, both federal and state. Many of the available funds come in the form of grants, should the project meet eligibility requirements. Additional financing options are available such as passenger facility charges (PFCs) and private investment.

The following sections list available sources and detail the eligibility requirements for each. The amount of funding available from these sources will depend primarily on future levels of aviation activity at GCN and future federal reauthorizations.

Table 6D
20-Year CIP Funding Sources (in 000s)
Grand Canyon National Park Airport

	Project Costs		Funding Sources	
	2017 Dollars [1]	Inflated [2]	Federal [3]	ADOT
FY 2018	$1,755	$1,755	$1,598	$157
FY 2019	1,322	1,322	1,204	118
FY 2020	3,880	3,880	3,533	347
FY 2021	2,396	2,396	2,182	214
FY 2022	13,234	13,234	12,051	1,183
Subtotal	**$22,587**	**$22,587**	**$20,568**	**$2,019**
FY 2023 - 2027	$31,299	$38,762	$24,274	$14,488
FY 2028 - 2037	14,963	22,680	19,868	2,812
Total	**$68,849**	**$84,028**	**$64,710**	**$19,319**

[1] Represents CIP as presented in Exhibit 6B.
[2] Beginning in FY 2023, project costs were inflated at 2.7%, which reflects the most recent five-year average of *Engineering News-Record's* Construction Cost Index.
[3] Federal funds include funds from FAA AIP (entitlement and discretionary).
Source: Coffman Associates and DKMG Consulting, LLC

Federal Grants

Grants administered by the FAA through the AIP represent a critical capital funding source to implement the projects recommended in this Master Plan. Although the future status of the AIP is currently uncertain, for the purpose of this Master Plan, it is assumed that the AIP will continue to be authorized and appropriated at levels consistent with H.R. 658, the FAA Modernization and Reform Act of 2012.

The AIP formula stipulates that non-hub primary airports, such as GCN, are entitled to receive 90 percent in federal funding for AIP-eligible projects. However, there is an adjustment to these rates at some airports in Alaska, Arizona, California, Nevada, New Mexico, Oregon, Utah, and Washington due to the high percentage of Federally-owned lands in these states. As such, GCN is entitled to 91.06 percent in federal funding for AIP-eligible projects. AIP funds can be used for most airport improvement needs but not operating costs. AIP funds are typically not available for revenue-generating projects, so it may be difficult, though not impossible, for GCN to use these funds for projects designated to generate revenue

As shown on **Table 6D**, federal grants are estimated to be approximately $64.7 million from FY 2018 through FY 2037, all of which is assumed to be funded with entitlement grants. However, GCN may apply for both entitlement and discretionary grants both of which are further described below.

Entitlement Grants: Entitlement funds are distributed through grants by a formula currently based on the number of enplanements and the amount of landed weight of arriving cargo at individual airports. These funds are available to airports in the year they are first apportioned and remain available for the two fiscal years immediately following or three fiscal years in the case of non-hub primary airports such as GCN. In cases where entitlement funds are not used, the funds are redistributed to other airport

sponsors as discretionary funds and become "protected entitlement" funding in the next federal fiscal year. **Table 6E** presents the AIP entitlement calculation for GCN. This calculation is based on the enplanement forecasts presented in Chapter 2 of this Master Plan. As shown in the table, GCN is estimated to receive approximately $65.0 million in entitlement AIP grants from FY 2018 through FY 2037, which is sufficient to fund GCN's portion of federally eligible projects in the CIP. Annual entitlement grant collections in certain years may not be sufficient to fund certain project costs requiring short-term funding until the project costs can be reimbursed.

Table 6E
AIP Entitlement Calculation (in 000s)
Grand Canyon National Park Airport

	FY 2018	FY 2019	FY 2020	FY 2021	FY 2022	FY 2023 - 2027	FY 2028 - 2037
Enplanements for Entitlement	376	406	438	451	464	2,539	6,231
FAA Formula[1]							
$7.80 for 1st 50,000 Enplanements	$390	$390	$390	$390	$390	$1,950	$3,900
$5.20 for next 50,000 Enplanements	260	260	260	260	260	1,300	2,600
$2.60 for next 400,000 Enplanements	717	796	879	912	947	5,127	10,400
$0.65 for next 500,000 Enplanements	0	0	0	0	0	44	800
$0.50 for the remaining Enplanements	0	0	0	0	0	0	0
Total Calculated Entitlements	$1,367	$1,446	$1,529	$1,562	$1,597	$8,421	$17,700
Total Calculated Entitlements x 2	$2,734	$2,892	$3,058	$3,124	$3,194	$16,841	$35,401
2 Year Lag in Receipt of Grants	$2,468	$2,580	$2,734	$2,892	$3,058	$16,324	$34,972
Cumulative AIP Entitlement Grants		$5,048	$7,782	$10,674	$13,732	$30,056	$65,027

[1] The FAA formula is defined in 49 United States Code § 47114.

Discretionary Grants: At the beginning of each federal fiscal year, the FAA sets aside the amount of discretionary grants to fund the Letter-of-Intent payment schedules. The FAA approves discretionary funds for use on specific projects after consideration of project priority and other selection criteria. As previously mentioned, this analysis does not anticipate the use of discretionary grants to fund the CIP; however, GCN could apply for these grants should the need arise.

Arizona Department of Transportation

The State of Arizona also supports needed capital improvements at Arizona's public airports through its grant program. ADOT's Aeronautics Division administers the grant program through the State Aviation Fund. Funds are distributed across three major categories: Airport Development Grants Program, Airport Preventive Maintenance System, and Airport Loan Program. The Airport Development Grants Program is designed to provide 50 percent of the local share for projects receiving federal AIP funding, while the Airport Preventive Maintenance System may fund up to 90 percent of projects that maintain and protect aviation pavement surfaces. In addition, ADOT's Airport Loan Program was established to enhance the utilization of available state funds and provide a flexible funding source for eligible airport sponsors. However, GCN is owned and operated by ADOT as part of the State Aviation Fund; therefore, it is assumed that ADOT will fund the balance remaining after Federal grants are applied. As shown on **Table 6D**, approximately $19.3 million of the CIP is anticipated to be funded by ADOT.

Passenger Facility Charges

PFCs are authorized by Title 14 of the Code of Federal Regulations, Part 158 and are administered by the FAA. PFCs collected from qualified enplaned passengers are used to fund eligible projects. An airport operator can impose a PFC of $1.00, $2.00, $3.00, $4.00, or $4.50 per eligible enplaned passenger. Once a PFC is imposed, it is included as part of the ticket price paid by passengers enplaning at the airport, collected by the airlines, and remitted to the airport operator, less an allowance for airline processing expenses. The PFC legislation stipulates that if a medium- to large-hub airport institutes a PFC of $1.00, $2,00, or $3.00, they must forego 50 percent of their AIP entitlement funds. This increases to 75 percent if they charge a $4.00 or $4.50 PFC. Since GCN is classified as a non-hub airport, it does not have to forego any annual AIP entitlement funds.

Projects that are eligible for PFC funding are those that preserve or enhance the capacity, safety, or security of the air transportation system; reduce noise or mitigate noise effects; or furnish opportunities for enhanced competition between or among air carriers. PFCs cannot be used for revenue-generating facilities at airports, such as restaurants and other concession space, rental car facilities, public parking facilities, or construction of exclusively leased space or facilities.

GCN does not currently charge a PFC; however, PFCs remain a potential funding source should the need arise. Based on the airline/air charter enplanement projections presented in Chapter 2 of this Master Plan, a $4.50 PFC would generate an average of $415,000 in additional annual funding if implemented at the beginning of Phase 2.

Private Investment

Many airports use private investment when the planned improvements will be primarily used by a private business or other organization. Such projects are not ordinarily eligible for federal funding. Projects of this kind typically include hangars, fixed based operator facilities, fuel storage, exclusive aircraft parking aprons, industrial aviation use facilities, non-aviation office/commercial/industrial developments, and other similar projects. Private development proposals are considered on a case-by-case basis. Often, airport funds for infrastructure, preliminary site work, and site access are required to facilitate privately developed projects on airport property.

GCN does not list any projects in the CIP that are funded through private investment; however, this remains a viable option to fund future non-aviation development. For example, approximately 45 acres of land located to the north and northeast of the airport has been identified for potential non-aviation development. In addition, private investment is a potential revenue source when examining lease revenue generated from such options. In the case of these 45 acres, potential lease revenue could range from approximately $135,000 to $265,000 per year, which is approximately 10 percent of the land value.

FINANCIAL FEASIBILITY

This section of the financial analysis presents the projected revenues and operating expenses resulting from the daily operation of GCN. The goal of any airport should be the capability to support its own operation and development through airport revenues. This section also presents the ability of GCN to fund the local share of the CIP.

Revenues

GCN generates revenue through air tour operator fees, ground transportation fees, airline revenues, terminal concessions, land and facility leases, fuel flowage fees, ramp fees, and security fees. The largest of these revenue sources is generated from air tour operator tenants including Grand Canyon Airlines, Grand Canyon Helicopters, Maverick Helicopter, and Papillon Helicopters. A summary of these and other major tenant leases is presented in **Table 6F**.

Table 6F
Summary of Major Tenants
Grand Canyon National Park Airport

Lessee	Expiration	Area	Estimated Annual Revenue	Description
Grand Canyon Airlines	9/30/17	FBO	$12,000	Minimum annual rent plus landing fees, gate fees, % gift shop sales, and % air tour sales
Grand Canyon Airlines	9/30/17	Fuel Farm	$1,500	Minimum annual rent (annual CPI increase) plus % fuel sales and fuel flowage fees
Grand Canyon Helicopters	2/28/19	Heliport Ground Lease	$43,200	Minimum Annual Rent (annual CPI increase) plus % food and beverage sales, % air tour sales, and % retail sales
Maverick Helicopters	3/31/19	Heliport Ground Lease	$36,000	Minimum Annual Rent (annual CPI increase) plus % food and beverage sales, % air tour sales, and % retail sales
Papillon Helicopters	month to month	Indoor Terminal Advertising	$900	Annual rate
Papillon Helicopters	6/30/19	Heliport Ground Lease	$50,400	Minimum Annual Rent (annual CPI increase) plus % food and beverage sales, % air tour sales, and % retail sales
Paragon Skydiving	12/31/2016 extended to 6/30/2017	Terminal Tandem Parachute Operations	$18,100	Annual fixed rent plus landing fees, gate fees, % retail sales, and fuel flowage fees
Westwind Aviation	expired 6/30/2012; month to month	Terminal Gift Shop	$9,400	Annual terminal rent plus landing fees, gate fees, % gift shop sales, and commercial ground passenger fees
Westwind Aviation	month to month	Outdoor Terminal Advertising	$1,200	Annual rate

Source: GCN records

GCN currently charges fixed rates to all tenants and users of the airport and its facilities. These fees and charges, shown in **Table 6G**, were approved by the Arizona legislature under Title 17, *Transportation*, Chapter 2, Article 2 *Grand Canyon National Park Airport – Operation and Management*.

Table 6G
Summary of Airline Rates & Charges
Grand Canyon National Park Airport

	Current Rates		Current Rates
Landing Fee (per 000 lbs)		Fuel Flowage Fees (per gallon)	
Using operations area	$1.05	Fuel delivered to GCN	$0.03
Not using operations area	$0.30	Fuel sold at GCN	$0.07
Gate Fees		Terminal Fees	
Leaseholder (per flight)		Advertising Space (per sq ft)	
Less than 12,500 lbs	$1.00	Terminal and counter areas	$5.00
12,500 to 44,999 lbs	$5.00	Outdoor sign space	$8.00
45,000 to 99,999 lbs	$10.00	After hours terminal use (per hour)	$200.00
100,000 lbs to 199,999 lbs	$50.00	Direct phone space (per phone)	$35.00
200,000 lbs or greater	$75.00	Public address system (monthly subscription)	$35.00
Nonleaseholder (per flight)		Retail sales space (per sq ft)	$26.00
Less than 12,500 lbs	$1.50	Terminal counter space (per sq ft)	$26.00
12,500 to 44,999 lbs	$7.50		
45,000 to 99,999 lbs	$15.00		
100,000 lbs to 199,999 lbs	$100.00		
200,000 lbs or greater	$150.00		
Aircraft Parking Fees		Commercial Use Ramp Fees	
Single Engine		Terminal ramp area	
Monthly	$50.00	Per hour	$15.00
Daily	$5.00	Max per use	$60.00
Multi-Engine		Non-terminal ramp area	
Monthly	$100.00	Per hour	$10.00
Daily	$10.00	Max per use	$40.00
Security Fees (per flight)	$150.00		

Source: Arizona Title 17, *Transportation,* Chapter 2, Article 2 *Grand Canyon National Park Airport – Operation and Management*

Table 6H presents revenues for FY 2016 through FY 2037. GCN's largest source of revenue is derived from air tours, which is included in "Other passenger aeronautical fees" and accounted for approximately 40 percent of the revenue in FY 2016. As shown in the table, revenues were approximately $1.3 million in FY 2016 and are projected to be approximately $2.6 million in FY 2022, reflecting a compound annual growth rate of 12.0 percent, which is primarily the result of an increase in ADOT funds and discussed in greater detail later in this section.

Table 6H
Pro Forma Cash Flow (in 000s)
Grand Canyon National Park Airport

	Actual FY 2016	Estimate FY 2017	Projected FY 2018	Projected FY 2019	Projected FY 2020	Projected FY 2021	Projected FY 2022	Projected FY 2023-2027	Projected FY 2028-2037
Revenues									
Other passenger aeronautical fees [1]	$521	$521	$544	$567	$599	$605	$612	$3,195	$7,226
FBO revenue	204	228	247	266	286	295	303	1,653	4,035
Parking and ground transportation	146	146	148	149	151	152	154	792	1,701
Land and non-terminal facility leases	125	125	127	128	129	131	132	679	1,464
Passenger airline landing fees	105	108	111	115	121	123	126	672	1,559
Fuel sales/fuel flowage fees	78	80	81	82	84	85	86	446	972
Other non-aeronautical	61	61	62	62	63	63	64	329	706
Terminal [2]	54	89	173	257	382	383	384	2,068	5,544
Other non-passenger aeronautical	4	4	4	4	4	4	4	21	42
Cargo and hangar rentals	1	1	1	1	1	1	1	5	10
ADOT funds [3]	0	0	0	0	0	0	702	11,956	0
Total revenues	$1,299	$1,364	$1,498	$1,632	$1,820	$1,842	$2,567	$21,814	$23,257
% change		5.0%	9.8%	9.0%	11.5%	1.2%	39.4%		
Operating expenses[4]									
Personnel compensation & benefits	$716	$716	$730	$743	$758	$772	$787	$4,163	$9,597
Communications & utilities	191	191	194	198	202	206	210	1,109	2,557
Supplies & materials	80	80	81	83	84	86	88	464	1,069
Contractual services	35	35	36	36	37	38	39	204	469
Other	239	239	243	248	252	257	262	1,388	3,200
Total operating expenses	$1,260	$1,260	$1,284	$1,308	$1,333	$1,359	$1,384	$7,326	$16,892
% change		0.0%	1.9%	1.9%	1.9%	1.9%	1.9%		
Net revenues	$39	$104	$214	$324	$486	$484	$1,183	$14,488	$6,365
CIP 5			($157)	($118)	($347)	($214)	($1,183)	($14,488)	($2,812)
Profit/(Loss)	$39	$104	$57	$205	$139	$269	$0	$0	$3,553

[1] Includes revenue from air tour operators.
[2] Includes revenue from rents, apron/tie down charges, and retail and duty free.
[3] Reflects the contribution needed from ADOT in order for GCN to breakeven.
[4] Only those expenses directly allocated to GCN are included; therefore, items paid through ADOT's central costs on behalf of GCN are not included.
[5] Reflects the balance of the CIP remaining after federal grants are applied as shown on Table 6D.

FY 2017 revenues are estimated to increase 5.0 percent over FY 2016 actuals primarily as a result of an increase in FBO revenues, passenger airline landing fees, and security screening fees. FY 2017 through FY 2037 revenues are projected based on the following:

- Historical trends and lease provisions.
- Revenues from landing fees, terminal fees, FBO, fuel sales, security screening, and terminal concessions are projected to increase with prospective passenger activity growth.
- Air tour revenue is projected to grow with Grand Canyon National Park attendance as shown in Chapter 2.
- ADOT funds are projected at an amount necessary for GCN's profit/(loss) to remain positive or breakeven assuming the CIP is funded with GCN net revenues.
- With the exception of fixed leases and penalty fees, remaining revenues were inflated at 1.0 percent annually to reflect a more conservative growth rate than that used for operating expenses.

- It was assumed that GCN would renegotiate the leases that expire during the planning period with terms and conditions that would implement changes in rate structures and business practices, as necessary, to maintain positive financial performance.

Operating Expenses

Operating expenses at GCN include personnel compensation and benefits, communications and utilities, supplies and materials, contractual services, and other charges and obligations. Only those expenses directly allocated to GCN are included; therefore, items paid through ADOT's central costs on behalf of GCN are not included. FY 2016 operating expenses reflect actual expenses provided by ADOT and FY 2017 amounts reflect estimates based on actuals through February 28, 2017. **Table 6H** presents operating expenses for FY 2016 through FY 2037.

As shown in the table, operating expenses were approximately $1.3 million in FY 2016 and are estimated to remain stable in FY 2017. Operating expenses are projected to be approximately $1.4 million in FY 2022, reflecting a compound annual growth rate of 1.6 percent from FY 2016 through FY 2022. Operating expenses are projected based on a review of historical trends and the anticipated effects of inflation assumed at 1.9 percent annually, reflecting the 10-year average of the Consumer Price Index for the west urban region. The projects included in Phase 1 of the CIP are not anticipated to increase operating expenses. However, projects included in Phase 2 and Phase 3, such as a replacement terminal building and runway extension, are likely to increase operating expenses. Since these projects are past the five-year horizon, their impacts on operating expenses are uncertain, and therefore, operating expenses were not increased. In addition, GCN intends to undertake various sustainability measures that may decrease operating expenses and are discussed in greater detail in Chapter 7.

Pro Forma Cash Flow

Table 6H presents GCN's pro forma cash flow for the 20-year planning period based on the projection of revenues and operating expenses previously discussed. According to **Table 6D,** the balance remaining after federal grants are applied to the CIP is approximately $19.3 million. **Table 6H** shows the ADOT contribution necessary for GCN to maintain profitability or breakeven while funding the CIP balance. ADOT funds are projected at an amount necessary for GCN's profit/(loss) to remain positive or breakeven assuming the CIP is funded through GCN net revenues. This results in a 39.4% increase in revenues in FY 2022 due to the funding needed for several airfield projects in FY 2022, including the rehabilitation of Runway 3-21, construction of runway shoulders, and improving airfield fencing. Additional ADOT funds are required in Phase 2 primarily due to the construction of a new terminal building.

Financial Feasibility Summary

The financial feasibility of future projects will be determined by the provisions of existing and future leases, funding levels and participation rates of federal and state grant programs, the availability of other funding sources, and the ability to generate internal cash flow from operations at GCN.

The financial projections were prepared on the basis of available information and assumptions set forth in this chapter. It is believed that such information and assumptions provide a reasonable basis for the projections to the level of detail appropriate for an airport master plan. Some of the assumptions used to develop the projections may not be realized, and unanticipated events or circumstances may occur. Therefore, the actual results will vary from those projected, and such variations could be material. Based on these assumptions, the CIP as it is presented can be financed in the future if sufficient ADOT funding is available.

MASTER PLAN IMPLEMENTATION

To implement the Master Plan recommendations, it is key to recognize that planning is a continuous process and does not end with approval of this document. The Airport should implement measures that allow them to track various demand indicators, such as passenger enplanements, based aircraft, hangar demand, and the quantity and type of aircraft operations. The issues that this Master Plan is based on will remain valid for a number of years. The primary goal is for GCN is to best serve the air transportation needs of the region, while continuing to be as economically self-sufficient as possible.

The actual need for facilities is best established by activity levels rather than a specified date. For example, projections have been made as to when a new replacement terminal building may be needed at the Airport. In reality, the timeframe in which the development is needed may be substantially different. Actual demand may be slower to develop than expected. On the other hand, high levels of demand may establish the need to accelerate development. Although every effort has been made in this Master Plan process to conservatively estimate when facility development may be needed, aviation demand will dictate timing of facility improvements. In addition, numerous projects have been identified that will not depend on increased demand. These include improving airfield safety standards, enhancing airfield geometry, and regular pavement maintenance.

The value of this study is keeping the issues and objectives at the forefront for managers and decision-makers. In addition to adjustments in aviation demand, when to undertake the improvements recommended in this Master Plan will impact how long the plan remains valid. The format of this plan reduces the need for formal and costly updates by simply adjusting the timing of project implementation. Updating can be done by the Airport manager and ADOT, thereby improving the plan's effectiveness.

In summary, the planning process requires ADOT to consistently monitor the progress of GCN in terms of passenger enplanements, aircraft operations, based aircraft, and peaking characteristics. Analysis of

aircraft demand is critical to the timing and need for new facilities. The information obtained from continually monitoring Airport activity will provide the data necessary to determine if the development schedule should be accelerated or decelerated.

GRAND CANYON
NATIONAL PARK AIRPORT
ARIZONA

Chapter Seven

SUSTAINABILITY

AIRPORT MASTER PLAN

ADOT

AIRPORT MASTER PLAN ADOT

Chapter Seven

SUSTAINABILITY

The sustainability element of the Airport Master Plan is intended to assess Grand Canyon National Park Airport's (GCN or Airport) current baseline sustainability performance and to develop a program that enhances the Airport's long-term sustainability strategy. The overall goal of the sustainability element is to:

- Support the economic vitality of the Airport;
- Ensure the efficient use of limited resources;
- Reduce negative environmental impacts; and,
- Enhance the social well-being of the community.

This process begins with the baseline assessment (Part 1), which examines current resource consumption and emission rates, summarizes sustainability efforts already undertaken by the Airport, and provides a context for sustainability in the regional area. The baseline information provides the framework for developing the sustainability management plan (Part 2), which will guide the sustainability strategy for the Airport into the future. The Sustainability Management Plan (SMP) provides a detailed evaluation of specific objectives and outlines an action plan to support plan implementation. A final step of the SMP is to establish a sustainability report card to allow Airport staff to monitor the performance of the sustainability management plan over time and to gauge the impact of individual initiatives as they are implemented.

GRAND CANYON
NATIONAL PARK AIRPORT
ARIZONA
ADOT

PART 1 – BASELINE ASSESSMENT

The Sustainability Baseline Assessment provides an inventory and review of GCN's current sustainability performance as determined by its related activities, policies, and procedures. This evaluation is an important first step in the development of the Airport's long-term sustainability strategy. The data collected in the baseline assessment will also enable the Airport to measure its sustainability performance over time, as well as the impact of individual initiatives.

SUSTAINABILITY & GRAND CANYON NATIONAL PARK AIRPORT

The Airport is owned and operated by the State of Arizona (State) and operated by the Arizona Department of Transportation (ADOT). Undertaking a Sustainable Master Plan shows that ADOT is committed to a sustainable future for the Airport and contributing toward the sustainability of the region and Grand Canyon National Park (GCNP). This Sustainability Baseline Assessment, and subsequent implementation of the Sustainability Management Plan, will help reduce the overall impact of the Airport on its environs while creating an example for airports around the nation looking to achieve sustainability.

As stated in the introduction to this Master Plan, an important aspect of sustainability is to promote principles that emphasize environmental stewardship, economic growth, and social responsibility. This Triple Bottom Line approach – balancing the needs of the natural environment, airport economics, and community – will position the Airport to be a sustainability role model for the entire region. The overarching goal of this sustainability component aims to balance aviation activities with environmental preservation of the surrounding environs, which includes GCNP, Kaibab National Forest, and the Town of Tusayan.

BASELINE ASSESSMENT CONTENTS

The Sustainability Baseline Assessment addresses nine resource categories. These categories provide a comprehensive overview of what the Airport is doing that is sustainability minded, as well as identify areas for improvement. This Sustainability Baseline Assessment will present current emission and consumption data, as well as relevant information to each category. An initial list of potential improvement opportunities will be noted as well, though these should be considered conversation starters as they are not final. A two-phased approach is used to develop a Sustainable Management Plan for GCN and includes the establishment of baseline sustainability goals and objectives, followed by developing sustainability performance targets and implementation strategies.

SUSTAINABILITY RESOURCE CATEGORIES

- Air Quality
- Planned Development
- Resiliency & Preparedness
- Energy
- Natural Resource Management
- Waste Management
- Land Use
- Construction Methods
- Water

As defined by the Airports Council International – North America (ACI-NA), airport sustainability is "a holistic approach to managing an airport so as to ensure the integrity of the **E**conomic viability, **O**perational efficiency, **N**atural resource conservation, and **S**ocial responsibility (EONS) of the airport". The EONS approach emphasizes operational efficiency in addition to the Triple Bottom Line, ensuring efficient airport operations. The EONS approach thus helps airports measure success by the traditional financial bottom line as well as by the achievements in stimulating economic growth, protecting natural resources, being socially responsible, and efficiently operating facilities. Given the water scarcity issues in the southwest region, along with the high cost of water, that baseline category is discussed in the water and energy sections of the EONS wheel, as shown in **Figure 7A**.

Figure 7A
Baseline Inventory Topics by EONS Category

AIR QUALITY

According to the Environmental Protection Agency (EPA) (2015), U.S. aircraft are responsible for 11 percent of greenhouse gas (GHG) emissions in the transportation sector, and three (3) percent of the total GHG emissions in the U.S.[1] While there is still some uncertainty on the exact impact the aviation industry has on climate change, it is known that the accumulation of GHGs increases the amount of energy held in the atmosphere, which has been linked to changes in Earth's climate. Consistent with Executive Order 13514 *Federal Leadership in Environmental, Energy, and Economic Performance,* GHGs for the purposes of this discussion include:

- Carbon dioxide (CO_2)
- Methane (CH_4)
- Nitrous oxide (N_2O)
- Sulfur hexafluoride (SF_6)
- Hydrofluorocarbons (HFC)
- Perfluorocarbons (PFC)

GHGs are both naturally occurring and anthropogenic (man-made). Aircraft jet engines, similar to other vehicle engines, produce CO_2, H_2O, nitrogen oxides (NO_x), carbon monoxide (CO), sulfur oxides (SO_x), volatile organic compounds (VOCs), particulates, and other trace compounds. During combustion, CO_2 accounts for the largest portion of emissions. Due to the amount released during engine combustion and its innate properties, CO_2 is the most important GHG to monitor. It remains in the atmosphere for up to 100 years, causing short- and long-term impacts, both locally and internationally. Climate change impacts include increased air temperatures, sea level rise, and more frequent and intense storms.

The Federal Aviation Administration (FAA) is currently leading or participating in several efforts intended to clarify the role that commercial aviation plays relative to GHGs and climate change. The most comprehensive and multi-year program geared towards quantifying aviation induced climate change effects is the Aviation Climate Change Research Initiative (ACCRI), funded by the FAA and the National Aeronautics and Space Administration (NASA). ACCRI hopes to reduce key scientific uncertainties in quantifying aviation-related climate impacts and to provide timely scientific input to inform policy-making decisions.

The FAA also funds ASCENT, the Aviation Sustainability Center, also known as the Center of Excellence for Alternative Jet Fuels and Environment. The goal of ASCENT is to create scientific solutions for the aviation industry's largest challenges, ranging from alternative jet fuel supply to

GHG Emission Scopes by ACERT

- ***Scope 1: Direct Emissions***
  Emissions owned & controlled by GCN (i.e., electricity generation & Airport vehicles).
- ***Scope 2: Indirect Emissions***
  Emissions from off-site electricity generation that GCN purchases.
- ***Scope 3: Indirect & Optional Emissions***
  Emissions owned & controlled by on-site tenants & stakeholders; includes aircraft-related emissions; emissions from tenants; & passenger & staff ground travel to & from

[1] https://www3.epa.gov/otaq/documents/aviation/420f15023.pdf

ACERT Emission Types

- ***Total aircraft, passenger, and cargo operations***
- ***Fuel use by airport and tenant vehicles***
- ***Electricity purchased by the airport operator and tenants***
- ***Aircraft taxi and APU usage times and engine run-ups***
- ***Glycol (deicing fluid) use***
- ***Landside traffic estimates of passenger and staff ground access.***

GREENHOUSE GAS EMISSIONS INVENTORY

In addition to GHGs generated from the combustion of fuels, there are many other airport activities that result in harmful emissions. These include vehicles used for transporting passengers to and from the airport, ground support equipment (GSE), airport maintenance and operations vehicles, and the use of utilities, such as electricity. ACERT outputs GHG emissions totals that are categorized by the scopes (direct, indirect, and indirect and operational). This analysis used the most recent information available, which was provided by the Airport and credible online sources. Tenant information, except for aircraft operations and public travel to and from the Airport, were not factored into this analysis. The only buildings considered in this model are the terminal building, administration building, residential area, and the aircraft rescue and firefighting (ARFF) station (shown on **Figure 7B**). There were some additional energy and water users factored in, including the runway lighting, water towers and Airport entrances, shown on **Figure 7C**.

altitude and speed optimization.[2] The Transportation Research Board's (TRB) Airport Cooperative Research Program (ACRP) also published the *Guidebook on Preparing Airport Greenhouse Gas Emissions* Inventories (Guidebook) in 2009, which helps airports define where emissions are emanating from using three different categories of emissions scopes. These Scopes are used in the Airport Carbon and Emissions Reporting Tool (ACERT) Version 3.1 (2015) developed by the Airports Council International (ACI).

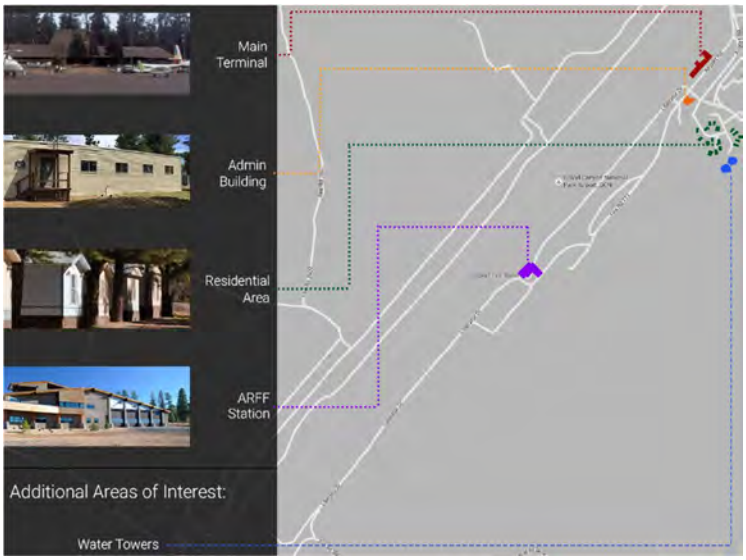


FIGURE 7B
Airport Buildings Audited by Quest Energy Group

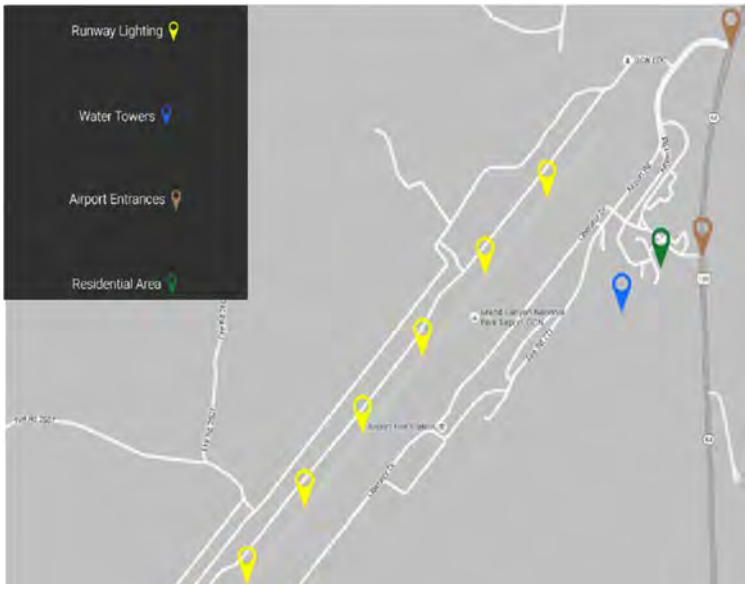


FIGURE 7C
Additional Energy Users

[2] https://ascent.aero/

Aircraft Operations

Table 7A summarizes the annualized operational fleet mix for GCN. These totals are based on information provided by the Airport operator. ACERT includes emissions factors that comprise all phases of operation (run up, taxi, takeoff and landing) for the 2015 fleet mix. Emissions factors for aircraft LTOs are calculated based upon average fuel consumption and times in various modes of operations. The aircraft times-in-mode applied in the ACERT model are summarized in **Table 7B**. For cases when an aircraft is not available in ACERT, ACI recommends selecting a comparable aircraft. Additionally, nine generic aircraft (examples include one engine helicopter or two-engine piston) are available to the user in ACERT. The number of operations (one takeoff or one landing) is multiplied by the corresponding emission factor to calculate the GHG emissions associated with aircraft operations.

A limitation of the ACERT model is the absence of emissions factors for military aircraft. There are two types of military aircraft that operate at GCN without a direct equivalent including the F-18 Hornet (airplane) and UH-60 Blackhawk (helicopter). Substitutes for the F-18 Hornet and UH-60 Blackhawk were found by placing the operations under aircraft types available in ACERT with similar thrust or horsepower. For the F-18 Hornet, each engine produces 11,000 pounds of thrust. The CL-604, which is available in ACERT, produces 9,220 pounds of thrust. The thrust of the F-18 Hornet is thus 1.2 times greater than the CL-604. The number of F-18 Hornet operations can then be approximately assumed to equal 1.2 times the amount of operations of a CL-604. Therefore, the 100 operations that are listed in **Table 7A** *do not* represent what was recorded in ACERT. Rather, the operations were entered as 120 CL-604 operations. F-18 Hornets, which often use afterburners on takeoff, create an additional 6,750 pounds of thrust when using afterburners that is not accounted for in the CL-604 operations. An identical process was followed for the UH-60 Blackhawk using a comparison of horsepower, ultimately entering 788 operations under the Bell AB-119 (note: no afterburners used on this aircraft).

Based on ACERT guidance, the total operations input should be within 10 percent of the stated operations total. The modeling assumptions presented in **Table 7A** are compliant with this guidance and are considered to adequately represent aircraft emissions for the purposes of this inventory.

TABLE 7A
Baseline Operational Fleet Mix (2015)
Grand Canyon National Park Airport

Aircraft Type	Number of Operations (2015)
Itinerant Operations	
Single Engine Piston	
Single Engine Fixed Propeller	2,767
Single Engine Variable Pitch Propeller	2,766
Multi-Engine Piston	
Beech Baron	300
Turboprop	
King Air 200	500
Beech 1900	5,000
Bombardier Q-400	0
Cessna Caravan	10,491
DHC-6 Twin Otter	10,491
C-130 Hercules	300

TABLE 7A (Continued)
Baseline Operational Fleet Mix (2015)
Grand Canyon National Park Airport

Aircraft Type	Number of Operations (2015)
Small Fanjet (<30,000 lbs.)	
Citation I-VII	300
Medium Fanjet (30,000 – 90,000 lbs.)	
Falcon 900	100
Challenger 600/604 / Citation X	50
ERJ-140/CRJ-200	200
ERJ-170/CRJ-700	0
F-18 Hornet	100
Large Fanjet (<90,000 lbs.)	
Gulfstream V	50
Boeing 737-700	100
Helicopter	
Bell 206	30,253
Eurocopter EC130/AS350	30,253
McDonnell Douglas MD-900	10,000
UH-60 Blackhawk	204
Total Itinerant Operations	**104,225**
Local Operations	
Single Engine Fixed Pitch Propeller	250
Single Engine Variable Pitch Propeller	250
Turboprop (Cessna Caravan/DHC-6 Twin Otter)	250
Helicopter (Bell 206)	125
Helicopter (Eurocopter EC130/AS350)	216
Military (UH-60 Blackhawk)	453
Military (C-130)	100
Total Local Operations	**1,734**
Total Annual Operations	**105,959**

Source: Coffman Associates Analysis

TABLE 7B
ACERT Model – Applied Aircraft Times-in-Mode

Aircraft Group	Takeoff (minutes)	Climb (minutes)	Approach (minutes)	Idle (minutes)
Jet	0.7	2.2	4.0	1.0
Business Jet	0.4	0.5	1.6	1.0
Turboprop	1.5	2.5	4.5	1.0
Piston	0.3	5.0	6.0	1.0
Helicopter	0.0	6.5	6.5	7.0

Source: ACERT Greenhouse Gas Emissions Inventory Tool – Emissions Factors for Aircraft

Non-Aviation Fuel Use

Non-aviation fuel use includes fuels, such as gasoline and diesel, available for vehicles that are primarily used at GCN, including Airport maintenance and airline service. This fuel is not available for commercial sale and does not include fuel purchased for vehicle trips to or from the Airport. **Table 7C** summarizes the non-aviation fuel use inputs for GCN for fiscal year 2016 (July 1, 2015 – June 30, 2016), which includes gasoline and diesel. These figures are reported in liters as the ACERT tool requires all inputs using the metric system.

TABLE 7C
Non-Aviation Fuel Source (liters)
Grand Canyon National Park Airport

Unit	GCN
Gasoline	62,993
Diesel	31,279
Total	**94,272**

Source: Airport staff
Includes fuel use by ADOT-owned vehicles/equipment

Electricity

The Airport purchases electricity from Arizona Public Services (APS) to power the ARFF station, the airport administration building, the terminal building, and on-Airport housing, all of which can be seen on Exhibit 1D. In addition to these landside facilities, there are additional energy users on site, including: runway lighting, water towers, runway beacon, and airport entrances (north and south ends). Electricity consumption in 2015 for these airside and landside facilities totaled 510,582 kilowatt hours (kWhs). Note that this figure *does not* include independent Airport tenants, including the air tour operators who purchase and manage utilities separately. More information regarding electrical utilities can be found in the Energy section of this baseline assessment, as well as in **Appendix C**, which shows the full energy audit performed by Quest Energy Group (June 2016).

On-Site Firefighting Activity

There is very little firefighting training performed on Airport property. There is a burn pile for brush and scrap wood that is maintained; however, no retardant is used, and foam is used only occasionally. Therefore, the inputs for fuel used for fire training and CO_2 extinguisher used for training or firefighting systems were both entered as zero.

Deicing Fluid Use

Propylene glycol, commonly referred to as glycol or deicing fluid, is a liquid that is combined with water and applied during winter months at airports to remove ice or snow from aircraft or airport pavement surfaces to enhance operational safety. ACERT includes an emissions factor for GHGs emitted through the deicing process. This is calculated in accordance with the quantity of glycol dispensed at the Airport during a year. Based on information provided by the Airport, there has been no deicing fluid used in the

last three years. Further, the deicing truck on site was removed. As a result, Airport deicing fluid use was estimated at zero.

Landside Traffic Estimates

Within ACERT, landside traffic estimates are based on the number of Airport and tenant employees, as well as the estimated number of deliveries per day to each tenant. GCN employs 12 people and there are 11 tenants that operate on-site. The number of tenant employees were not factored in to this analysis. Based on information provided by the Airport, there are approximately 300 vehicle visits per day to the Airport. Since passenger activity at GCN primarily consists of tour operations, the number of passengers taking connecting flights was entered as zero. There is no scheduled public transportation servicing the Airport to record; however, the primary forms of transportation to/from GCN were estimated at 40 percent cars, 40 percent truck/SUV/light duty vehicles, and 20 percent bus. Road travel by Airport staff was estimated to be less than 2,000 miles per year by passenger car (entered as 3,219 km in ACERT). All other forms of corporate travel (rail, air, sea) were estimated at zero miles per year. The estimated average trip length made by staff, passengers, or delivery vehicles to or from the airport was entered as 11 km, which is equivalent to approximately seven miles, the distance from the Airport entrance to the Grand Canyon Visitor Center.

Table 7D lists all Airport-owned vehicles and combustion engine equipment directly controlled by GCN (Scope 1 emissions) that are included in the GHG emissions inventory.

TABLE 7D
Existing Airport Equipment Fleet
Grand Canyon National Park Airport

Equipment Type	Subclass	Year	Make and Model	Mile Usage (gal)[1]	Fuel Type
Vehicle Equipment					
Truck	P/U ½ ton, 4X4	2008	Ford F150	2,324	Gasoline
Truck	P/U ½ ton, 4X4	2008	Ford F150	1,799	Gasoline
Truck	1-ton dump	2001	Dodge R3500	582	Diesel
Truck	P/U ½ ton, exterior cab, 4X4	2011	Ford F150	5,321	Gasoline
Truck	P/U ½ ton, crew cab, 4X4	2011	Ford F150	4,611	Gasoline
Truck	1.5-ton aircraft rescue	2006	Ford F550	3,895	Diesel
Truck	1.5-ton air stair	2008	Ford F350	16	Diesel
Truck	Aircraft rescue	2008	E-One P-502	0	Diesel
Truck	Aircraft rescue	1985	Oshkosh T1500	0	Diesel
Truck	Sweeper	2013	Elgin Broom Bear	70	Diesel
SUV	SUV 4X4	2007	Ford Explorer	764	Gasoline
UTV	4X4	2015	Kubota RTV1100C	165	Gasoline
Van	½-ton, 8-passenger	2008	Chevrolet G1500	1,569	Gasoline

TABLE 7D (Continued)
Existing Airport Equipment Fleet
Grand Canyon National Park Airport

Equipment Type	Subclass	Year	Make and Model	Mile Usage (gal)[1]	Fuel Type
Snow Removal Equipment					
Machinery	Snow blower, 4X4	2009	Oshkosh H2723B	0	Diesel
Truck	Snowplow 6.5 CY	2004	Mack CV712	616	Diesel
Truck	Snowplow 6.5 CY w/ wing, 4X4	1997	IHC 5000	1,225	Diesel
Truck	Snowplow 6 CY	1993	IHC 2574	1,611	Diesel
UTV	4X4 w/ front plow	2015	Kubota RTV1100C	88	Gasoline
Miscellaneous Equipment					
Air Compressor	Electric, 17.1 CFM	1986	Rolair H5380GE	0	N/A
Generator	DSL 480 KW	1996	Cummins VTA28G2	2	Diesel
Generator	200 KW	1995	Kohler 200R0Z07	41	Diesel
Machinery	Loader backhoe	1986	Case 580K	52	Diesel
Machinery	Mower Seeder	1989	Ford 7710FC415M	153	Diesel

[1] For the calculations in ACERT, the gallons used in the mile usage column was converted to liters
P/U: Pickup
Source: Grand Canyon National Park Airport, reporting period July 1, 2015 – June 30, 2016

BASELINE GHG EMISSIONS BY SCOPE AND SOURCE

TABLE 7E
ACERT Global Warming Potentials

Greenhouse Gas	Global Warming Potential
CO_2	1
CH_4	21
N_2O	310

Source: ACERT v3.1, 2015

Based on federal GHG protocols, GHG emissions are expressed as metric tons of carbon dioxide equivalent (MT CO_2e). CO_2e is a term used for describing different GHGs in a common unit. For any quantity and type of GHG, CO_2e represents the amount of CO_2 that would have the equivalent global warming impact (expressed as global warming potential). **Table 7E** lists the global warming potential for all GHGs that ACERT uses to quantify airport emissions. As previously mentioned, combustion is the primary GHG producing activity at airports, and CO_2 is the GHG emitted in the largest portion from combustion. The ACERT protocol thus states that the remaining combustion-related GHG be converted to MT CO_2e, which is accomplished within the tool. Based on the assumptions and methodology discussed above, a baseline GHG emissions inventory was prepared.

Using the previously defined Scopes, **Figure 7D** and **Table 7F** summarize the distribution of direct (Scope 1), indirect (Scope 2), and indirect and optional (Scope 3) GHG emissions. The GHG emissions model indicates that Scope 3, which includes all tenant and public activity, accounts for the largest portion of emissions at the Airport, of which aircraft emissions account for the highest use. GHG emissions from aircraft make up just over 80 percent of all emissions. The second greatest emissions source is from the transportation of the public – almost entirely by private vehicle – to and from the Airport. To provide context of what emissions mean to the average consumer, the EPA provides a GHG equivalencies calculator.[3]

[3] https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator

Scopes 1 and 2 – directly controlled by GCN – account for 570 MT CO_2e. This is the equivalent of:

64,139 gallons of gasoline *OR* **1,366,094 miles driven by an average passenger vehicle**

Scope 3 and public emissions account for 10,824 MT of CO_2e. This is equivalent to:

11,550,237 pounds of coal burned *OR* **1,598 homes' electricity use for one year**

Emissions related strictly to aircraft operations, which includes aircraft landing and takeoffs (LTO), engine run-ups, and aircraft auxiliary power unit (APU) account for a total of 9,201 MT of CO_2e. Total aircraft emissions within the ACERT model can be thought of in terms of:

376,134 propane cylinders used for home barbeques *OR* **122 tanker trucks' worth of gasoline**

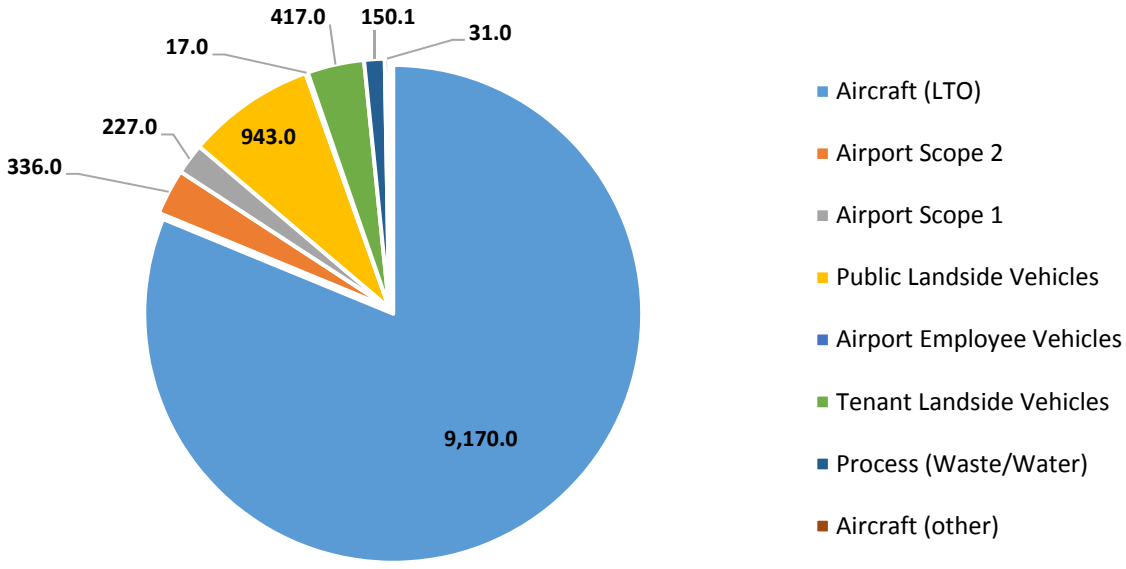


FIGURE 7D
GHG Inventory – Scopes 1, 2 and 3 (in tons of CO_{2e})
Grand Canyon National Park Airport

TABLE 7F
Greenhouse Gas Inventory Summary
Grand Canyon National Park Airport

Entity	Source User	Source Type	Scope	CO_2 [1]	CH_4 [1 2]	N_2O [1 2]	CO_{2e} [1]	CO_{2e} %
Airport Operator	Airport	Airside Vehicles	1	227	0.0349	0.0172	234	2.05%
	Airport	Buildings (gas/oil/coal)	1	-	-	-	-	0.00%
	Airport	Fire Training	1	-	-	-	-	0.00%
	Airport	Emergency Generator	1	-	-	-	-	0.00%
	Airport	Glycol	1	-	-	-	-	0.00%
	Subtotal Scope 1		**1**	**227**	**0**	**0**	**234**	**2.05%**
	Airport	Electricity Purchased	2	336	-	-	336	2.24%
	Airport	Heat Purchased	2	0	-	-	-	0.00%
	Subtotal Scope 2		**2**	**336**	**0**	**0**	**336**	**2.95%**
						Airport Operator Subtotal	**570**	**5.00%**
Tenants and Employees	Tenant	Aircraft Landings & Takeoffs (LTO)	3	9,170	0.2933	-	9,176	80.54%
	Tenant	Aircraft Auxiliary Power Unit (APU)	3	16	0.0005	-	16	0.14%
	Tenant	Aircraft Engine Run-ups	3	15	0.0145	-	15	0.13%
	Tenant	Aircraft De-icing	3	-	-	-	-	0.00%
	Tenant	Airside Vehicles	3	-	-	-	-	0.00%
	Tenant	Buildings (gas/oil/coal)	3	-	-	-	-	0.00%
	Tenant	Electricity Purchased	3	0	-	-	-	0.00%
	Tenant	Heat Purchased	3	-	-	-	-	0.00%
	Tenant	Emergency Generator	3	-	-	-	-	0.00%
	Tenant	Fire Training	3	-	-	-	-	0.00%
	Tenant	Staff/Visitor Vehicles	3	417	0.0448	0.0352	428	3.76 %
	Off-site	Process Water (waste/water)	3	150.1	1	0	198.5	1.74%
	Airport	Employee Vehicles	3	17	0.0018	0.0015	18	0.16%
	Airport	Staff Business Travel	3	0	-	-	0	0.00%
						Tenant/Off-site/Staff Subtotal	**9,853**	**86.48%**
Public (including passengers)	Ground Access	Cars, taxi, tour bus	3	943	0.17	.08	971	8.52%
		Public bus, shuttles	3	-	-	-	-	-
		Rail	3	-	-	-	-	-
						Public Subtotal	**971**	**8.52%**
Subtotal Scope 3			**3**	**10,728**	**2**	**0**	**10,824**	**95.00%**
Total CO_{2e} Emissions (tons)				**11,291**	**2**	**0**	**11,393**	**100.00%**

[1] All GHG emissions measured in metric tons
[2] Not converted to CO_2e until CO_2e column
Note: Subtotals and totals may not add up due to rounding.
Source: ACERT v3.1, October 2016

AIR TOUR GHG EMISSIONS

As was mentioned, the ACERT model accounts for aircraft emissions only during the takeoff/climb/approach and idle phases for all aircraft operations at GCN, including air tour operations. As a result, emissions from air tour operations over the GCNP are not fully accounted for in the ACERT model. A separate model, the Aviation Environmental Design Tool (AEDT), does allow for calculation of aircraft emissions in space and time to estimate fuel consumption and emissions. Utilizing this model and applying the estimated operational data, established air tour routes through the GCNP, and the known air tour fleet mix, a full emissions impact of the air tour operations at GCN has been prepared. Air tour routes are based on the GCNP Special Flight Rules Area (SFRA), including helicopter routes with operating altitudes of 7,500 feet mean sea level (MSL) and fixed-wing routes with operating altitudes between 8,500 and 9,500 feet. These air tour routes range in length from 46 nautical miles (nm) to 84 nm. **Table 7G** provides a breakdown of the air tour operational fleet mix and estimated 2015 operations, the total fuel burn in gallons for those aircraft, and the CO_2e emissions from those operations. The results show a total emissions impact of 8,162 CO_2e in 2015.

GHG emissions for all other aircraft operations using the AEDT model was not prepared since specific route and flight plan information, such as origin/destination airports and operational altitudes for all other operations, are unknown.

TABLE 7G
Air Tour Operations – Greenhouse Gas Emissions Summary
Grand Canyon National Park Airport

Aircraft	2015 Operations	2015 Fuel Burn (gallons)	CO_{2e} [1]
DHC-6 Twin Otter	10,491	62,286.68	602
Cessna Caravan	10,491	187,756.11	1,814
Bell 206	30,253	135,657.04	1,311
Eurocopter EC130/AS350	30,253	149,598.87	1,445
McDonnell Douglas MD-900	10,000	309,389.24	2,989
Total	**91,488**	**844,687.93**	**8,162**

Source: AEDT Emissions Modeling Tool
[1] All GHG emissions measured in metric tons

FEDERAL CRITERIA POLLUTANTS EMISSIONS INVENTORY

This inventory is performed in addition to GHGs because there are no federal standards for aviation-related emissions that have been adopted. There are six federal criteria pollutants regulated under the National Ambient Air Quality Standards (NAAQS). The AEDT is the FAA-approved software that models aircraft performance in space and time to estimate fuel consumption, emissions, noise, and air quality consequences. The results of the AEDT criteria pollutants inventory

Federal Criteria Pollutants
- ***Carbon monoxide (CO)***
- ***Ozone (O_3)***
- ***Sulfur dioxide (SO_2)***
- ***Nitrogen dioxide (NO_2)***
- ***Particulate matter (PM_{10} and $PM_{2.5}$)***
- ***Lead (Pb)***

for GCN are summarized in **Table 7H**. According to the U.S. EPA's *Green Book – Arizona Nonattainment/Maintenance Status for Each County by Year for All Criteria Pollutants,* as of October 1, 2015, Coconino County is in attainment for all of the NAAQS standards.

TABLE 7H
2015 Emissions Inventory (Tons per Year)
Grand Canyon National Park Airport

Pollutant	Aircraft Operational Emissions (tons/year)
CO	0.430
VOC	0.010
NO_x	0.114
SO_x	0.016
PM_{10}	0.003
$PM_{2.5}$	0.003
Pb^1	0.026

[1] AEDT does not calculate emissions for lead (Pb). Lead calculations using EPA's *Calculating Piston-Engine Aircraft Airport Inventories for Lead for the 2008 National Emissions Inventory*, December 2010
Source: AEDT, October 2016

POTENTIAL OPPORTUNITIES FOR PERFORMANCE IMPROVEMENT

Unfortunately, airports do not have the authority to directly reduce aircraft emissions; however, the Airport can issue non-mandatory operational procedures to help reduce aircraft emissions. In addition, ADOT can reduce emissions from ADOT-owned/operated vehicles, airside facilities, and buildings. The following suggestions are sustainable opportunities that the Airport can explore further.

Indoor Air Quality

- Prohibit smoking within 25 feet of all entries, outdoor air intakes, and operable windows.
- *Use operable windows in place of the HVAC system when the temperature allows.*
- Use free cooling (a system that brings in 100 percent outside air) when conditions allow.

Outdoor Air Quality

- Implement anti-idling measures for vehicles within Airport environs.
- Post occupancy signs on roadways and in parking areas to reduce the number of circuits a driver makes around the Airport during wayfinding.
- Improve GHG reporting by aircraft, mobile, stationary sources, and waste management.
- Implement GSE idling restriction.
- Publish voluntary operating procedures that encourage de-rated take-off and thrust, limit power-back and reverse thrust, and advise multi-engine aircraft to use a single or reduced engine when taxiing.
- As vehicles and equipment are retired, promote the purchase of replacement units with hybrid options, or ones that are powered with alternative fuels, like compressed natural gas.
- Achieve Airport Carbon Accreditation Level 1 or 2 through a program administered by ACI.

ENERGY

Quest Energy Group (Quest), performed a comprehensive energy audit of ADOT-owned and operated buildings at the Airport to assist in identifying and prioritizing potential energy and water conservation measures. The full report can be found in **Appendix C**.

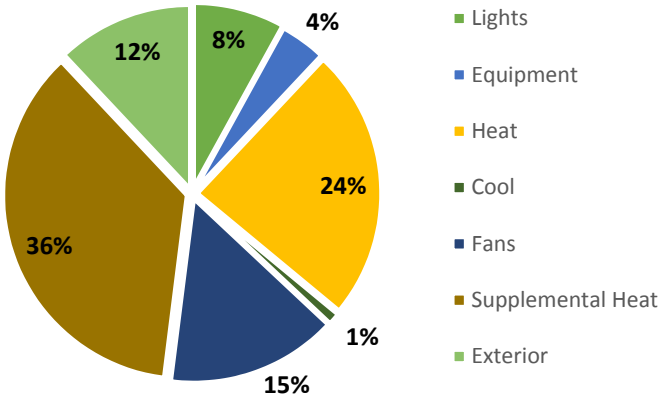


FIGURE 7E
ARFF Station Electric Energy (kWh)
Grand Canyon National Park Airport

ENERGY AUDIT

To conduct this audit, Quest constructed a detailed baseline model of each building, adjusting and validating the accuracy of the results by comparing them with the real-life building behavior. This process is known as calibration, which is initiated by running the model simulation using actual weather data from the site over a one-year performance period. The simulated energy and power outputs are then compared to the historical utility data for the same period, and the model inputs are refined to make the simulated behavior match the actual data as closely as possible. Model input adjustments are typically made on the basis of sub-metered data, trend data, and operational details provided by Airport staff. This iterative process is repeated until the accuracy of the model is within reasonable tolerances (+/- 5% mean bias error [MBE] as recommended by International Performance Measurement & Verification Protocol [IPMVP]).

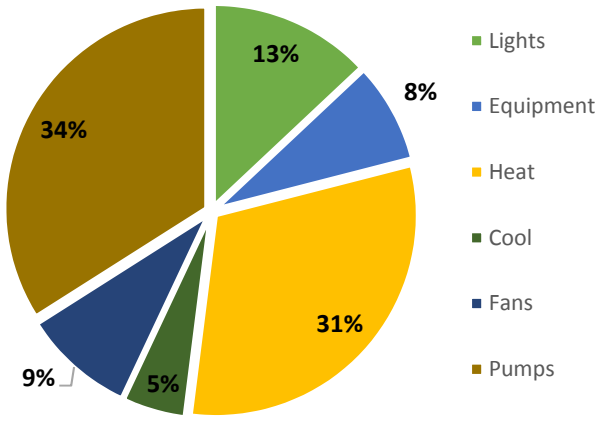


FIGURE 7F
Terminal Building Electric Energy (kWh)
Grand Canyon National Park Airport

Because of the regional climate, there is a substantial heating load in the winter, but minimal cooling during summer months. The terminal's water room equipment also accounts for a lot of energy use. The remainder of the energy costs consist of interior and exterior lighting, plug loads, and ventilation and distribution equipment. **Figures 7E, 7F, and 7G** show the energy use at the three buildings analyzed by Quest.

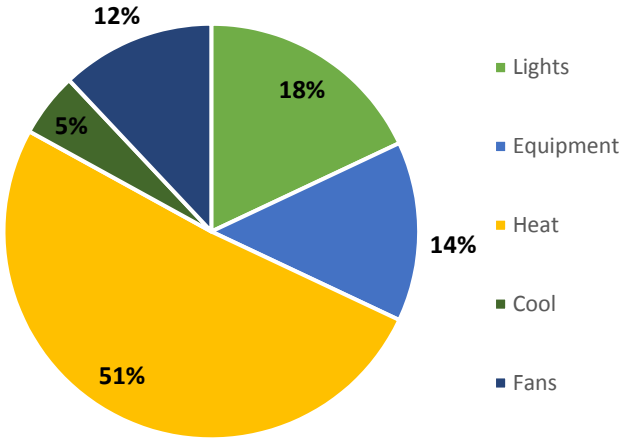


FIGURE 7G
Administration Building Electric Energy (kWh)
Grand Canyon National Park Airport

KEY AUDIT FINDINGS

Energy use at the Airport includes consumption of aviation fuel (Jet A and 100LL), gasoline, and diesel fuel for vehicles and maintenance equipment, and electricity, provided by APS. Natural gas is not available as a fuel source at GCN.

ADOT spent $123,298 on electric and water consumption during 2015 for the buildings analyzed in this study. There are additional businesses on Airport property that ADOT pays for, but the Airport is reimbursed for these costs (amounting to $38,406 in 2015). ADOT operates as a pseudo-water utility by way of pumping and distributing potable water to several commercial and residential consumers leasing land and/or buildings on Airport property. A significant portion of the energy consumption of the property is dedicated to this function, in addition to the basic energy requirements of operating the Airport property.

Utility bills for 2014 and 2015 were analyzed for the assessed buildings. Water consumption is included as a component of the energy use as it is a significant contributor to electric utility costs due to heating and pumping. As indicated in **Table 7J**, water is nearly as expensive as electricity, which is unusual for commercial buildings – even for heavy-water users.

TABLE 7J
Baseline Utility Summary
Grand Canyon National Park Airport

Meter	Total Utility Cost	
	2014	2015
Electric	$87,087	$78,989
Water[1]	$58,194	$82,715
Total	**$145,281**	**$161,704**
Meter	**Total Utility Use (Average 2014 – 2015)**	
	Cost	**Usage**
Electric	$83,038	510,582 kWh
Water[1]	$70,455	2,621,623 gallons
Total	**$153,493**	

[1] Some usage includes submetered water from businesses situated on the airport property
Source: Grand Canyon Airport Energy Audit Report, Quest Energy Group (June 2016)

ELECTRIC UTILITY DATA

As mentioned, APS provides all electrical power to GCN. The terminal building, ARFF station, and administration building are all electrically powered, with more details summarized in **Tables 7K and 7L**. In addition to the building energy uses, there are several other features at GCN that consume electricity, including:

- Entrance lighting (on from dusk to dawn);
- Airfield lighting (operates during the day and when activated by pilots when the ATCT is closed);
- Beacon (operates from dusk to dawn and during periods of low visibility).

TABLE 7K
Electricity Costs
Grand Canyon National Park Airport

Component	Summer	Winter
Energy (kWh/kW)	$0.100 up to 200 $0.063 over 200	$0.087 up to 200 $0.046 over 200
Peak Demand (kw)	$9.82 up to 100 kW $5.21 over 100 kW	$9.82 up to 100 kW $5.21 over 100 kW

Source: Grand Canyon Airport Energy Audit Report, Quest Energy Group (June 2016)

Quest's Energy Audit report notes that water savings would have an associated electrical savings for the Airport as pumping requirements would be reduced. Given the relatively high energy demand penalties, the Airport has many opportunities to install new equipment and thermostats to optimize the heating schedule, as outlined in the recommendations. The Airport has installed all LED lighting on the airfield, the Airport roadway, and the parking lot lights; however, opportunities for building lighting retrofits remain.

TABLE 7L
Building Energy Audit
Grand Canyon National Park Airport

Name	Square Footage	Year Built	Heating	Cooling	Other End Uses	Operational Schedule
Terminal Building	14,000	1950's	Electric Heat	Direct expansion	Pump Center	6am-7pm W 6am-8pm S
ARFF Station	22,000	2010	Electric Heat & Heat Pump	Direct expansion	N/A	6am-8pm
Administration Building	4,000	1980's	Electric Heat	Air Conditioning	Office Equipment	8am-5pm M-F

M-F: Monday through Friday
W: Winter
S: Summer
Source: Grand Canyon Airport Energy Audit Report, Quest Energy Group (June 2016)

Table 7M summarizes the measures, existing condition and subsequent recommended action, as well as estimates for initial cost, savings and payback in years, for each of the buildings and energy users sur-

veyed. This analysis provides an estimated return on investment should the Airport decide to move forward with any of the recommendations. Detailed annual results for each building are available in **Appendix C**.

TABLE 7M
Energy Efficiency Recommendations with Cost and Savings Based on Existing Conditions
Grand Canyon National Park Airport

Measure	Existing Condition	Recommended Action	Initial Cost	Savings	Payback
TERMINAL BUILDING					
Insulation	South wall not insulated	Add insulation; caulk & seal other penetrations	$15,000	$387	37.58 yrs
LED Lighting	4' T8 fluorescent fixtures & halogen lights	LED fixture replacement as needed	$3,211	$947	2.05 yrs
HVAC	Split system condensing units & indoor air-handlers	Add rooftop heat pumps; high efficiency heat pump; air-side economizer & CO_2 sensors	$15,000	$5,281	2.61 yrs
Reduce Infiltration	Motion-controlled doors let outside air in	Add secondary door or air-curtains	$3,000	$1,589	1.89 yrs
Water System	Complicated delivery system; equipped with two, 20HP pumps & two, 150 HP pumps	Use existing pressure from elevation of storage tanks & automated controls for water release & variable speed drives	$50,000	$5,394	9.27 yrs
ARFF STATION					
EMS Computer	No central HVAC control	Upgrade hardware & computer equipment to control HVAC	$5,000	$1,293	3.55 yrs
ADMINISTRATION BUILDING					
LED Lighting	2x4 T8 fluorescent troffers	LED fixtures & 8-14W A-Lamps to replace CFLs	$496	$188	1.69 yrs
Re-program Thermostats	Thermostats heat inefficiently	Replace thermostats; program to heat/cool in 15-min intervals	$200	$1,761	0.02 yrs
Heat Pump	AC units use electric strip heat for heating	Replace AC units w/ heat pumps	$7,200	$1,058	6.15 yrs
ADDITIONAL USERS					
Apron Lighting	Metal halide fixtures with 1 to 2 heads	Retrofit with LEDs; remove every other pole & add 3-light heads to remaining poles	TBD	$5,389	TBD
Entrance Lights	Charged $20/month/light regardless of use	Add dedicated solar panel w/ battery backup	$7,500	$522	14.38 yrs

TBD: To be determined
Source: Grand Canyon Airport Energy Audit Report, Quest Energy Group (June 2016)

POTENTIAL OPPORTUNITIES FOR PERFORMANCE IMPROVEMENT

- Replace the existing air conditioning units in the administration building to heat pump technology when they are due for replacement.
- Re-program thermostats to vary when heating comes on (instead of all at once like it is currently). Some thermostat upgrades may also provide savings opportunities.

- The water distribution system operates in a complicated manner of bi-annual deliveries, manual operation, and wasted pumping pressure. At the next remodel, control upgrades and a re-design of the system could provide an opportunity for reduced operating costs.
- Add insulation to the exterior walls of the terminal building.
- Reduce infiltration of the terminal building by adding secondary doors or air curtains that would reduce the amount of outside air rushing in to the building.
- Fluorescent lamps are the most prevalent form of lighting among the buildings, including less efficient lighting technology, such as incandescent and halogen fixtures. There is a significant opportunity to reduce recycling cost and save on lighting energy costs in every building by switching to LED technology in all light fixtures.
- Adopt the International Energy Conservation Code to address the design of new or reconstructed energy-efficient building envelopes and installation of energy-efficient mechanical, lighting and power systems through requirements emphasizing performance.[4]
- Add a 30kW solar photo voltaic (PV) system to the terminal building as the orientation of the building and local climate make this energy source a good choice for long-term cost savings.
- Install an additional 25kW solar PV system to the ARFF station as there is a large amount of exposed roof that could support this system.

NATURAL RESOURCE MANAGEMENT

GCN is uniquely situated amid the Kaibab National Forest, as well as GCNP. It is bounded by a perimeter fence and has cleared much of its native vegetation; however, game and other wildlife still occur on the property. Rain Tank, a large freshwater pond, is located southwest off the approach end of Runway 3.

Kaibab National Forest surrounding GCN
Source: Coffman Associates

LANDSCAPE MANAGEMENT

The Airport does not have a formal landscape management plan in place. However, the Airport is mindful of water scarcity issues and thus practices xeriscape principles on site, including the residential areas. Of the 23 residential units at the Airport, only one tenant is using irrigation at his/her residence. The existing plants on Airport property also do not

Xeriscaping is landscaping with slow-growing, drought-tolerant plants that are often native to the region, designed to conserve water.

[4] http://www.iccsafe.org/codes-tech-support/codes/2015-i-codes/iecc/

require any water inputs. The ARFF station also practices xeriscape landscaping methods, which uses native plants to reduce water consumption. Other landscape management includes mowing between the taxiway and runway, as well as around the residential area The Airport also contracts to Conn Pest Control to spray chemicals and/or pesticides at all Airport-managed buildings (terminal building, administration building, new and old ARFF station, 15 Airport employee residences, and maintenance barn) in March, June, August, and November to control pests on-site. The Airport does not spray at non-employee residences, the Town, or for any commercial tenants.

NATURAL ENVIRONMENT

Vegetation in the area is moderately open woodland, which is mostly ponderosa pine, Douglas and white fir, aspen pine, Gamble oak, juniper, and pinion pine. Understory grasses are mountain muhly, Arizona fescue, pine dropseed, blue grama, and dropseeds.[5]

PROCUREMENT

The Airport does not have a procurement policy as it relates to sustainability, such as incentivizing purchases of materials from local vendors or purchasing materials with recycled or organic content. Rather, the Airport Manager follows Arizona procurement rules (unless in case of emergency) which authorizes $5,000 dollars per month on a personal card (P card). Other Airport employees also have P cards, which represent a significant component of the annual expenditures. Based on a review of fiscal year (FY) 15 expenditures for the Airport, the most frequently purchased products are those relating to the maintenance and operations of the facilities.

POTENTIAL OPPORTUNITIES FOR PERFORMANCE IMPROVEMENT

- Formalize existing landscape management practices.
- Consider LEED Operations and Maintenance (LEED O+M) certification to green internal building and janitorial practices or implementation of other green cleaning policies in Airport buildings.
- Reduce or eliminate toxic pesticide use Airport-wide.
- Create and implement a sustainable procurement policy that emphasizes local sourcing and waste reduction (i.e., ordering supplies and equipment in bulk to reduce packaging waste) to lessen impact on natural resources, as well as prioritizes products with eco-labels (i.e. USDA Organic, Forest Stewardship Council) over conventional ones.
- Implement a green concessions policy to kick start implementation of an internal healthy food initiative, sourcing local snacks to put in the vending machine, as well as for a future Airport restaurant.
- Install bottle refill stations and encourage the use of reusable drink bottles.

[5] https://apps.azdot.gov/files/Airports/MP_PDF/GCN_MP_02.pdf

LAND USE

The built environment around an airport is guided by the FAA to ensure that land uses in the area are compatible with airport operations. This ensures both the safety of the surrounding uses, as well as the minimization of noise disturbances that aircraft operations can cause. The Airport is in Tusayan, which comprises 16.8 square miles. The *Town of Tusayan General Plan* considers the Airport property to be a transportation land use. As shown on **Figure 7H**, the primary surrounding land use is open space, which is made up of the Kaibab National Forest and GCNP. Due its proximity to the Kaibab National Forest, the Airport is included in the Wildland-Urban Interface (WUI) area. A WUI refers to the transition zone between unoccupied land (in this case the Kaibab National Forest) and human development (the Airport). Land uses northeast of the Airport include commercial, residential, and mixed-use land uses, including some public land uses north of the run way. Existing land uses near the Airport are shown on Exhibit B3 in Appendix B.

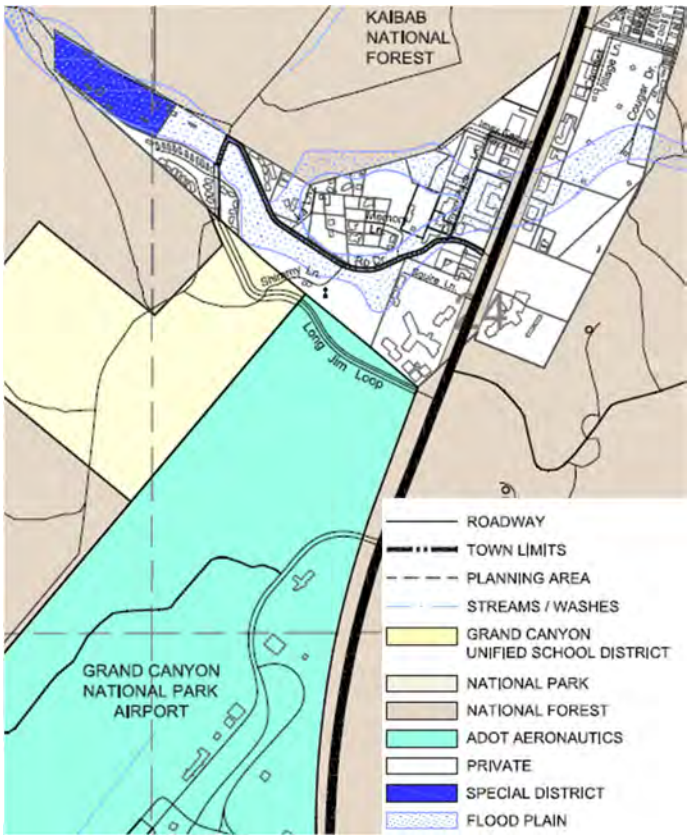


FIGURE 7H
Land Use Map
Source: Town of Tusayan 2014

The existing land uses on Airport property include:

- Aviation-related infrastructure
- Businesses
- Support services
- Facilities
- Tusayan Town Hall
- Airport's management office building
- Town and Airport employee residences

Some portions are not developed for aviation, including 23 residences for town and Airport employees. Housing within the town is limited and most residents live in employer-provided housing consisting of apartments, dormitories, or mobile/manufactured houses.

TRANSPORTATION

There are no public roads owned and maintained by the Town of Tusayan; streets within the Town are private. The main highway through the community, Highway 64, as well as U.S. Forest Service (USFS) roads and roads on the Airport site, are owned and maintained by ADOT and the USFS. Highway 64 provides access to the South Rim of GCNP, approximately one mile north of the Town of Tusayan. The primary forms of transportation of people from GCN, Tusayan, and the GCNP include rental cars, private

vehicles, tour busses and shuttle busses. The Airport estimates that approximately 100 tour busses or shuttle busses drop visitors off at the Airport daily in the summer time, as well as 200 trips per day made in cars/personal vehicles to the Airport during the same time period. Given that driving is the primary form of transportation around Tusayan and the GCNP, congestion on the roads and in parking lots is common.[6] To combat congestion, Tusayan has implemented the Tusayan Park and Ride, a free shuttle service. This route operates during spring break, summer, and fall weekends to accommodate the long lines at the entrance station and crammed parking lots on the South Rim. The Park and Ride route does not extend to the Airport; however, visitors can walk approximately 0.7 miles from the Airport to the Squire Inn (Stop #2) to catch the shuttle to the GCNP. **Figure 7J** shows the Tusayan Park and Ride route and **Table 7N** provides an overview of other all routes available around Tusayan and the GCNP.[7]

Congestion entering GCNP
Source: National Park Service

Figure 7J
Tusayan Park and Ride Route Map
Source: National Park Service

In addition to the Tusayan Park and Ride Shuttle, there are three other shuttle routes that provide access to the Grand Canyon Village. Although these other lines do not service the Airport, they are available to riders who get off the Tusayan Park and Ride Shuttle at the Grand Canyon Visitor Center and can connect to the other shuttles from there. There is also the Grand Canyon Railway, which passes within approximately ¾-mile of the western boundary of Tusayan. It can be picked up at the Grand Canyon Village, which Airport visitors could connect to via the shuttle system. There is no on-site rental car agency available at the GCN. Taxi services are available 24 hours per day at the Airport.[8]

[6] https://www.nps.gov/grca/planyourvisit/tusayan-route-purple.htm
[7] https://www.nps.gov/grca/planyourvisit/tusayan-route-purple.htm
[8] https://www.nps.gov/grca/planyourvisit/gettingaround.htm

TABLE 7N
Transit Routes Serving the Grand Canyon National Park Area

Route & Transit Type	Hours of Operation	Time of Year Operation	Pick-up	Drop-off[2]	Stops
Shuttle Bus					
Tusayan Park & Ride (Purple)	8 am – 9:45 pm 40 min roundtrip	May – Oct.[1]	IMAX Theater in Tusayan	Grand Canyon Visitor Center	4
Village Route (Blue)	4 am – 10:30 pm; 50 min roundtrip	May – Sept.	Grand Canyon Visitor Center	Hermits Rest Route Transfer	13
Hermit Road Route (Red)	4 am – 1 hour after sunset 80 min roundtrip	March – May	Village Route Transfer (stops at 9 overlooks)	Hermits Rest (return trip only makes 4 stops)	13
Kaibab Rim Route (Orange)	4 am – 1 hour after sunset 50 min roundtrip	March – May	Grand Canyon Visitor Center	Yavapai Geology Museum or Yaki Point	5
Train					
Grand Canyon Railway	9:30 am – 5:45 pm[3] 4.5 hours roundtrip	Year-round	Williams, Arizona	Grand Canyon Village	0

[1] Shuttle services operate on a limited basis other times throughout the year; check website for exact schedule.
[2] All routes run on a loop to original pick-up location; drop-off indicates farthest point before turning around.
[3] Offers one trip per day; during peak season an additional train car leaves at 10 am and returns at 7:45 pm.
Source: https://www.nps.gov/grca/planyourvisit/tusayan-route-purple.htm; https://www.thetrain.com/the-train/schedule-routes/

AIRPORT TERMINAL AREA AUTO PARKING

There is a total of 220 spaces on the Airport site available to passenger vehicles and busses. This figure also includes spaces for handicapped parking, employee parking, and Airport management/operations.

GCN Terminal Auto Parking Area (looking south)
Source: ADOT

When the ARFF station was constructed in 2010, a new vehicle parking lot with 14 marked vehicle parking spaces, including reserved spaces for carpool vehicles and alternative fuel vehicles, was added. A summary of the Airport's total terminal area auto parking inventory is provided in **Table 7P**, with additional information summarized in the Access and Parking section of Chapter One.

TABLE 7P
Airport Terminal Area Auto Parking Inventory
Grand Canyon National Park Airport

Vehicle Type	Number of Spaces	Size (square feet)
Passenger Vehicle	145	47,850
Passenger Bus	34	23,120
Handicapped Parking	6	1,980
Employee Parking	30	9.900
Airport Management/Operations (Curbside)	5	1,650
Total Parking Spaces	**220**	**84,500**

Note: Total square footage is based on 330 sq. ft./passenger vehicle and 680 sq. ft./passenger bus, which includes the dimension of the parking stall space and maneuvering area.
Source: ADOT, Aeronautics Division; Airport Site Inspection, BWR, February 2003.

TRAIL SYSTEM

In addition to the established vehicular routes, the Town of Tusayan has an existing trail system that extends throughout the area. **Exhibit 7A** shows the existing and proposed trail structure in the *Town of Tusayan General Plan*. The trail system throughout Tusayan and around GCN have hardscape (concrete walkways) and softscape trails (natural paths). Both types of trails are set away from the road, making them safe for pedestrians on various modes.

LIGHTING

GCN Lighting
Source: Quest Energy Group (June 2016)

Tusayan has adopted Coconino County's Dark Sky Ordinance, as detailed in Section 17 of the Town's Zoning Code. Lighting systems required by the Airport for navigation purposes are exempt from this ordinance, but all other types of lighting – loading areas, hangars, terminal aprons, parking areas, etc. – must adhere to the ordinance. This ordinance is in place to protect the night sky, given the proximity to GCNP, which received Gold-tier International Dark Sky Park certification in 2016. Currently, all airfield lights are LED, as well as lighting on the Airport roadway and in the parking lot.

POTENTIAL OPPORTUNITIES FOR PERFORMANCE IMPROVEMENT

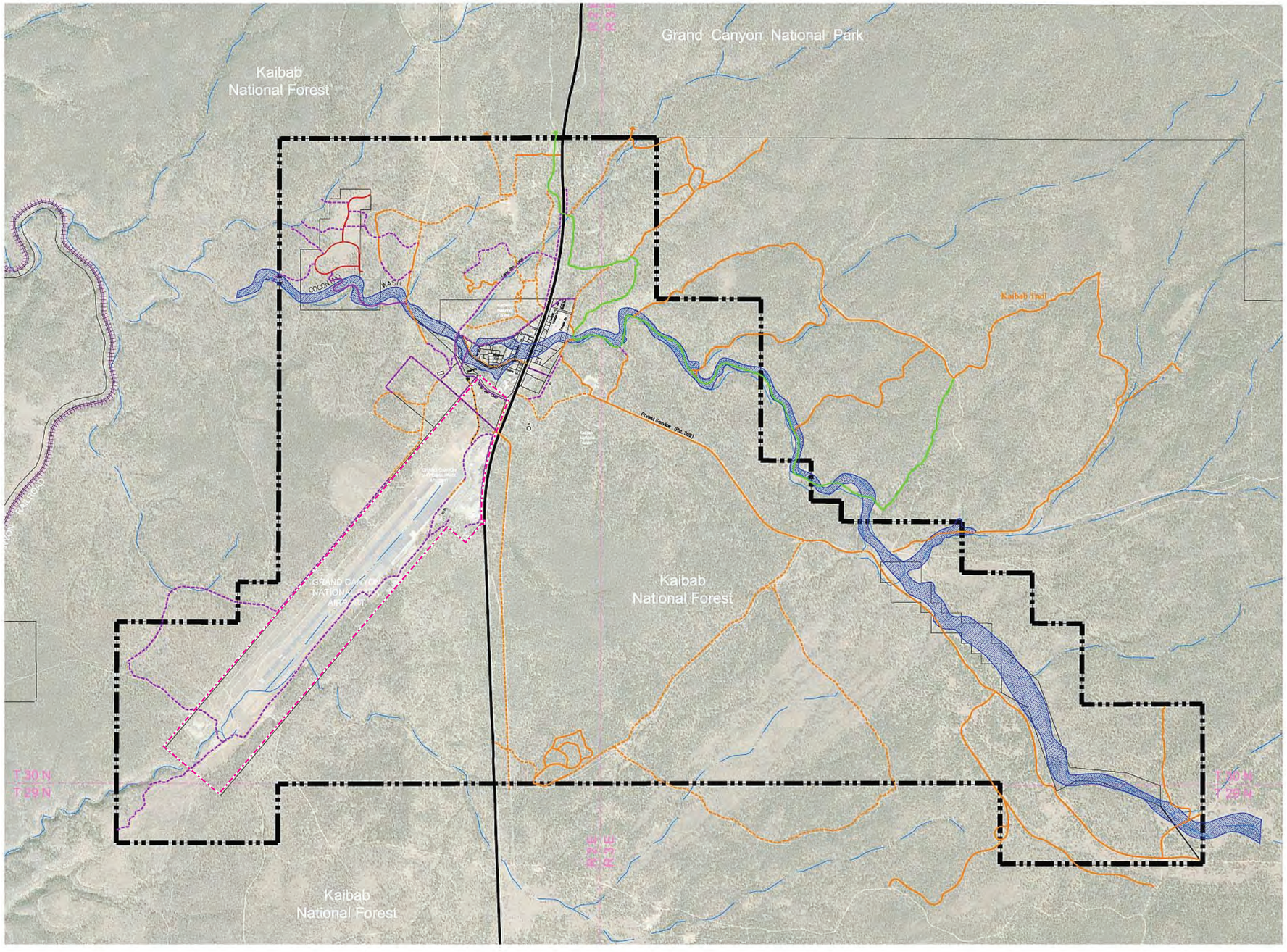
- Expand Park and Ride shuttle service to include an Airport stop.
- Adhere to the standards of the International Dark-Sky Parks' certification to complement the lighting goals and efforts of GCNP.
- Incentivize employees who live off Airport property to use alternate modes of transportation (i.e., something other than a private vehicle) to get from residences to work.

PLANNED DEVELOPMENT

With over five million visitors last year, the Airport, as well as Tusayan, have many tourists to accommodate. As such, there are several improvements being explored in the Airport Master Plan, as well as several Capital Improvement Projects (CIPs) the Town of Tusayan is pursuing.

The USFS recently blocked a proposal from the Town of Tusayan that would have established road and utility easements on National Forest System land.[9] If approved, this project would have paved the way for commercial and residential developments in Tusayan.[10] The proposal was returned on the grounds

[9] http://www.fs.usda.gov/detail/kaibab/home/?cid=fseprd493641
[10] http://www.fs.usda.gov/Internet/FSE_DOCUMENTS/fseprd493764.pdf



OVERALL LEGEND

- ROADWAY
- MAJOR ATERIALS / HIGHWAYS
- TOWN LIMITS
- PARCEL
- STREAMS / WASHES
- FLOOD PLAIN
- RAILROAD
- AIRPORT PROPERTY LINE

TRAILS LEGEND

- EXISTING TRAILS - MODERATE (+/-17.0 Miles)
- EXISTING TRAILS - EASY (+/-15.7 Miles)
- ARIZONA TRAIL
- PROPOSED TRAILS - MODERATE (+/-1.8 Miles)
- PROPOSED TRAILS - EASY (+/-14.5 Miles)

ROAD SYSTEM

- FUTURE PROPOSED ROADS

N

0 0.25 0.5 1.0
(MILES)

Source: Tusayan General Plan 2024

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that it was not consistent with the Kaibab Forest Plan, it would create an exclusive or perpetual right of use or occupancy, and it would stress GCNP's capacity based on the significant increases in visitation or occupation near the Park. Regardless of the USFS denial and opposition by local tribes, GCNP, the public, and the Forest Supervisor said a second application would be allowed if all nine of the minimum requirements found in 36 CFR 251.54(e)(1)(i)-(ix) were met.[11,12]

There are other CIPs happening in Tusayan (summarized in **Table 7Q**), as well as two projects on Airport property: The Tusayan Town Hall and Tusayan Employee Residences. Capital improvements at the Tusayan Town Hall focus on the parking lot and sidewalks. The initial phase allocated $50,000 dollars for these improvements, none of which has been spent. To date, the Town has invested $35,466 for improvements related to the Tusayan Employee Housing Project.[13]

TABLE 7Q
Capital Improvement Projects (CIPs) in Tusayan

CIP	Funding Source	Allocated Funds ($)						
		Spent YTD	Budgeted Total	FY 13/14	FY 14/15	FY 15/16	FY 16/17	Beyond 5 Years
Town Hall Parking Improvements/ Sidewalks	General Fund	0	50,000	0	0	0	0	0
Tusayan Employee Housing Project	General Fund	35,466	250,000	150,000	150,000	200,000	0	0
Tusayan Partners Park Development	General Fund	98,070	250,000	150,000	150,000	150,000	0	0
Fiber Optic Expansion	General Fund	0	275,000	150,000	150,000	150,000	0	0
Future Water System Investment	General Fund	0	0	1,200,000	1,200,000	1,200,000	0	0
Tusayan Affordable Housing Project	General Fund	0	0	50,000	200,000	250,000	250,000	500,000
Natural Gas Extension	General Fund	0	0	0	100,000	0	0	0
Drainage Study/ Model Update	General Fund	0	50,000	50,000	0	0	0	0
Bus Stop Art Program/Public Art "Set-Aside"	General Fund	0	40,000	15,000	15,000	15,000	15,000	0
Trail System Improvements	General Fund	0	15,000	30,000	0	0	0	0
Utility Under-grounding Project	General Fund	0	0	0	0	0	0	40,000
Snow Park	General Fund	0	0	0	0	0	0	0

YTD: Year-to-Date
FY: Fiscal Year
Source: Tusayan-az.gov/forms-documents/

[11] http://www.fs.usda.gov/Internet/FSE_DOCUMENTS/fseprd493786.pdf
[12] http://www.fs.usda.gov/Internet/FSE_DOCUMENTS/fseprd493645.pdf
[13] http://tusayan-az.gov/forms-documents/

POTENTIAL OPPORTUNITIES FOR PERFORMANCE IMPROVEMENT

- Concentrate future Airport development in a compact, human-scaled way, on previously disturbed lands that fosters walkability, specifically for on-site employees to get to work.
- Take advantage of the consulting services provided by the Coconino County Sustainable Building Program for any sustainable projects on site, as well as applying for awards for sustainable Airport development projects.
- Create and incorporate contract or bid language that requires sustainable practices for future contracts and projects (i.e., requiring construction and demolition waste to be recycled when applicable).
- Require all new or reconstructed developments to achieve LEED certification, Green Globes Program, or Living Building Challenge; similar to Resolution No. 2014-09 in Flagstaff requiring that the City incorporate sustainable building practices into the design, construction, and operation of all City-owned facilities.[14]

CONSTRUCTION METHODS

Although no formal green building policy exists at the Airport, green construction methods appear to be prioritized within the community. In the *Town of Tusayan General Plan*, it is cited that the Town wishes to go green to be a good neighbor to GCNP and the Kaibab National Forest. Further, the *Coconino County General Plan* cites developing green building incentives for new construction and remodeling projects as a first-year implementation priority. In the *Grand Canyon National Park Action Plan*, one of the strategies cited to reduce GHG emissions is to develop a schedule to bring existing buildings into LEED Existing Buildings Operations and Maintenance, as well as ensure that 100 percent of new construction meets LEED certification standards.

ARFF Station
Source: Quest Energy Audit, 2016

Coconino County established a Sustainable Building Program whose mission is to educate, support, encourage and help develop sustainable building practices and processes for the citizens of Coconino County. The program awards participants that meet the minimum requirements with a Sustainable Building Award Plaque. The program also offers consultation on sustainable building methods, materials, and resources for new and existing construction.[15]

[14] http://www.flagstaff.az.gov/documentcenter/view/43997
[15] http://www.coconino.az.gov/comdev.aspx?id=148

In 2010, the Airport erected the LEED Gold ARFF station. The building also received the Arizona Masonry Guild, Inc., Excellence in Masonry Architectural Award, the Fire Industry Equipment Research Organization's Merit Award for Fire Station Design, and the Advanced Level Plus Sustainable Building Award from the Coconino County Sustainable Building Program. The ARFF station also has an adjacent vehicle parking lot with spaces reserved carpool and alternative fuel vehicles. The building includes all EnergyStar appliances and passive heating from food waste heat to lessen its energy demand. It uses a xeriscape management plan in lieu of herbicides or pesticides. The building implemented a rainwater collection system with on-site distribution and a complete greywater system to help combat water issues.[16] A search of the USGBC directory identified buildings that are LEED certified throughout Coconino County, which are summarized in **Table 7R**. [17]

TABLE 7R
LEED Certified Buildings in Coconino County

Building Name	Location	Certification Level	Distance from Airport
Tusayan			
GRCA Employee Housing	700 Paiute Circle	Platinum	2.7 miles
Grand Canyon Science & Resource Management Building	17 South Entrance Rd.	Platinum	8.1 miles
Maintenance & Warehouse Facility	1 Shuttle Bus Rd.	Certified	6.4 miles
Flagstaff			
Museum of Northern Arizona	3101 N Fort Valley Rd.	Platinum	68.2 miles
12 buildings at Northern Arizona University Campus	South San Francisco St.	Silver, Gold and Platinum	72.0 miles
Wells Fargo Bank	2625 N. 4th St.	LEED O+M	72.9 miles
Kohl's	500 W Forest Meadow St.	LEED O+M & Certified	79.6 miles
Private Residence	1205 E Kandahar Lane	Gold	72.9 miles
Private Residence	3108 W Dannielle Dr.	Platinum	68.0 miles
Verizon Wireless Flagstaff Store	1430 E Route 66	Gold	50.2 miles
APS Flagstaff Admin Building	2200 E Huntington Dr.	Silver	82.4 miles
Drury Inn & Suites Flagstaff	300 North Milton	Silver	71.5 miles
Page			
Lake Powell Construction Office	459 Lake Powell Blvd.	Silver	77.5 miles

O+M: Operations and Maintenance
Source: http://www.usgbc.org/projects

POTENTIAL OPPORTUNITIES FOR PERFORMANCE IMPROVEMENT

- Create and implement a construction waste management plan to reduce waste related to construction and demolition.
- Source locally or regionally when products are available versus shipping products from long distances or overseas.
- Repurpose salvageable construction materials and recycle anything that cannot be reasonably reused.

[16] http://www.coconino.az.gov/comdev.aspx?id=148
[17] http://www.usgbc.org/projects?keys=grand+canyon

- Tie contractor and vendor submittals and documentation of sustainable practices to payments to ensure regular collection and review of backup documentation.

RESILIENCY AND PREPAREDNESS

The Airport has several plans in place to guide in the everyday operation of the Airport as well as during emergency situations. The GCNP Action Plan explains how the increasing global temperatures will affect all aspects of the water cycle, creating changes in precipitation patterns. Any instance of heavy rains or snow events could impact Airport operations. The adverse effects of these events can be mitigated by having resiliency and preparedness plans in place. This section will outline the plans that are in place and highlight areas that GCN should improve upon to avoid disruption of services during extreme weather events. Cyber, or computer-based, threats will also be discussed as this is a growing area of concern for the aviation industry.

Projections from climate change models and paleoclimate data suggest there may be a broad range of possible climate phenomena in the future. These research efforts identified the climate effects that would result in the most significant impacts to the transportation sector and their likelihood of occurrence, as summarized in **Table 7S**. The level of uncertainty is included with the climate effect as that is the most challenging aspect of managing climate risk. Some of these risks are not relevant to GCN, like the increase in hurricane intensity. As an inland airport, this is not a climate effect that GCN would need to prepare for. However, increases in intense precipitation events and flooding patterns would be a weather event that the Airport should consider in its resiliency and preparedness planning process.[18]

TABLE 7S
Climate Changes of Relevance to U.S. Transportation and Their Likelihood of Occurring

Potential Climate Changes of Relevance to U.S. Transportation	Level of Uncertainty
Temperature	
Increases in very hot days & heat waves	Very likely
Decreases in very cold days	Virtually certain
Increases in Arctic temperatures	Virtually certain
Later onset of seasonal freeze & earlier onset of seasonal thaw	Virtually certain
Sea level rise	Virtually certain
Precipitation	
Increases in intense precipitation events	Very likely
Increases in drought conditions for some regions	Likely
Changes in seasonal precipitation and flooding patterns	Likely
Storms	
Increases in hurricane intensity	Likely
Increased intensity of cold-season storms, with increases in winds & in waves & storm surges	Likely

Source: Transportation Research Board Airport Cooperative Research Program, Synthesis 33: Airport Climate Adaptation and Resilience (2012). Accessed: http://onlinepubs.trb.org/onlinepubs/acrp/acrp_syn_033.pdf

[18] http://onlinepubs.trb.org/onlinepubs/acrp/acrp_syn_033.pdf

The climate risks in **Table 7S** can cause two different types of risks to an airport: physical and business. Examples of physical risks are overloaded stormwater infrastructure caused by excessive precipitation or heat buckling on runways caused by an increasing number of hot days. Business risks are those that affect the airport's ability to meet its mission and responsibilities. Business risks are often a direct result of a physical risk, such as an airport closure resulting from flooding.

In addition to climate risks, Airport computer systems could also be at risk as cybersecurity threats become increasingly common. Functions critical to an airport's operations, such as flight information display systems, airfield lighting controls, heating and ventilation systems, access control devices, and a broad range of other mission-critical systems, rely on digital technology that may be vulnerable to attack. The Transportation Research Board Airport Cooperative Research Program recently published a Guidebook on *Best Practices for Airport Cybersecurity* (2015) that presents recommended practices on cybersecurity that airports should consider. The most common methods used by airports currently are virus protection software, network firewalls, and network password controls. However, there are additional measures that an airport can take to be better prepared for a potential cyber-attack.

Cybersecurity Best Practices

- ***Be aware of the threats that can impact critical data and systems through regular communication with peers and related agencies***
- ***Periodically train managers, staff, consultants, and tenants on their roles to protect data and system credentials***
- ***Identify vulnerabilities where assets are not adequately protected***
- ***Implement countermeasures to achieve appropriate level of protection***

EXISTING PLANS

Airport Certification Manual (ACM) – updated July 2013

- Defines the procedures to be followed in the routine operation of the Airport and for response to emergency situations (including aircraft rescue and firefighting, snow and ice control, Airport emergency plan, wildlife hazard management)

Emergency Rescue Grid Map – August 2014

- Depicts existing facilities at the Airport and a quadrant grid map for rapid response in the case of an emergency

Airport Emergency Plan (AEP)

- Provides guidance for a response to any emergency occurring at the Airport including natural disasters (such as forest fires), power failures, fuel farm fire, and water rescues
- Details emergency phone numbers, airport administration contact information and procedures for specific types and levels of emergencies

Snow and Ice Control Plan

- Outlines Airport snow removal crew responsibilities and required vehicles/equipment in the event of or forecast of snow and/or icy weather conditions

POTENTIAL OPPORTUNITIES FOR PERFORMANCE IMPROVEMENT

- Conduct a resiliency and preparedness study to address the reduction of vulnerabilities and how to build local resilience to climate variability and cyber-related impacts.
- Adopt an adaptive management style when it comes to airport planning. For instance, design and plan for airport features that can be easily altered given a future climate change impact.
- Adopt a climate change action plan that specifically relates to the airport and complements the GCNP Action Plan.

WASTE MANAGEMENT

SOLID WASTE

Solid waste disposal services for the Airport is provided by Waste Management, Inc. Solid waste is hauled to the Painted Desert landfill near Joseph City, Arizona, approximately 160 miles southeast of Tusayan. Given the distance the location is from the Airport, the weekly haulings result in a five-hour roundtrip for the Waste Management vehicles. Waste Management does use all natural gas vehicles to reduce their carbon footprint, but the remote location of GCN makes waste hauling a consumptive process. The Airport has a 6-yard and an 8-yard trash dumpster that are each emptied weekly. Assuming 90 percent capacity in each bin per weekly pickup, the annual amount of solid waste collected is approximately 655 cubic yards. These dumpsters hold the trash for all operations related to GCN, as well as the waste generated by the employees living on-site. However, all Airport tenants handle their own trash and thus are not included in the above figures.

6-Yard Trash Dumpster
Source: Arizona Waste Management

8-Yard Trash Dumpster
Source: Arizona Waste Management

RECYCLING

Recycling is also handled by Waste Management, Inc. The Airport has a 4-yard recycling container that is emptied every other week and hauled to Flagstaff Hauling and Transfer in Flagstaff, approximately 75 miles southeast of Tusayan. This facility accepts paper, cardboard, metal, and glass. Assuming 90 percent capacity every other week at pick-up, the Airport is recycling 93.6 cubic yards annually. The combined cost of waste and recycling services (based on FY2015) is $8,800 dollars.

4-Yard Recycling Container
Source: Arizona Waste Management

There are small, personal recycling canisters in the administration building and ARFF station. Recycling canisters are not provided to other tenants as they are responsible for their own recycling. The Airport currently does not advertise or provide any special instructions as to what can or cannot be recycled, nor do they make special arrangements for uncommon items, like batteries.

COMPOSTING

The Airport currently composts chip trees and maintains a pile of horse manure, which is used for landscaping and remediation of treated soil.

POTENTIAL OPPORTUNITIES FOR PERFORMANCE IMPROVEMENT

- Conduct regular (annual) waste audits to identify areas for improvement.
- Request a quote for solid waste and recycling from multiple solid waste providers.
- Reduce unnecessary dumpster pickups by only scheduling service when recycling and waste containers are at capacity.
- Work with solid waste provider to have compost (i.e., fruit and vegetable scraps) picked up or incorporate food scraps into existing chip trees and horse manure composting efforts.
- Partner with tenants to consolidate efforts and reduce the amount of times recycling and waste are hauled.
- Put out recycling bins for uncommon items, like batteries, ink cartridges, old electronics, etc., to reduce the number of products that end up in the landfill.
- Place signs throughout Airport-managed buildings and tenant facilities (if willing) that explain what can/cannot be recycled.

WATER

As a part of the energy audit conducted by Quest, water use was analyzed. Baseline water consumption was established using actual Airport use and equipment data, as well as industry standard assumptions for usage duration and water use intensities. The full Energy Audit Report, which includes detailed water use information, can be found in **Appendix C**.

Tusayan Sanitary District handles waste water from the Airport, which is processed at an eight-acre waste water treatment plant off Airport property. Potable water is received from Hydro-Resources and stored in two aboveground storage tanks located near the south intersection of Airport Road and Highway 64. Each tank can hold 1.4-million gallons of water and are re-filled twice per year. The Airport formerly had an operational self-contained rainwater containment system with 3.175 million-gal capacity. Due to its location between the runway and taxiway, which is within the runway safety area (RSA), the FAA required the Airport to eliminate the use of the system.

Grey water is wastewater collected separately from sewage, which originates from clothes washers, bathtubs, showers and/or sinks, but not from a kitchen sink, dishwasher, or toilet.

Future plans for a new terminal building design include a 10,000-gallon storage tank for the capture and use of rainwater for non-potable functions, such as in toilets and landscape irrigation. The Airport's existing but inactive water treatment system could also be reactivated to treat harvested rainwater from the terminal for potable uses. Based upon annual rainfall totals, which average 17 to 18 inches in the Grand Canyon area, it is estimated that a rainwater harvesting system on a new terminal, if used to its capacity and properly treated, could have provided 73 percent of the terminal's peak 2015 monthly water usage.[19]

Reclaimed water is former wastewater that is highly treated to remove solids and impurities.

There is also a freshwater retention pond, named Rain Tank, at the southwestern end of the Airport. Rain Tank is fed by stormwater runoff, precipitation, and melted snow from the Airport. Drainage on the central and southern parts of the Airport is conveyed via earthen swales and concrete or pipe culverts south into Rain Tank. Drainage on the northern part of the Airport eventually drains into Coconino Wash west of the Airport. Although there is currently no formal County policy requiring the use of reclaimed water or gray water, the *Coconino County Comprehensive Plan* (2015) strongly encourages the use of both water sources for landscaping purposes to conserve groundwater and save energy used for pumping groundwater.

CURRENT WATER USE

Records of water use from FY 2011 through FY 2016 indicates that the Airport has dramatically decreased its overall water use from approximately 3.5 million gallons in FY 2011 to just over 2.0 million gallons in

[19] Peak 2015 terminal building monthly water usage totaled 13,677 gallons during the month of September, based upon estimates prepared by Quest Energy Group.

FY 2015, a drop of approximately 42 percent. FY 2016 saw a rise in water use to 2.8 million gallons; however, a significant amount of this was the result of water leaks in two residences. Water costs have also come down, with the Airport spending approximately $96,600 for FY 2011 and just $55,300 in FY 2015, a decrease of approximately 43 percent. It should be noted that total water costs for FY 2016 were not available; however, estimated costs were calculated based upon the current rate of approximately $0.014 per gallon. FY 2016 water costs rose to $56,100; however, this slight increase is largely the result of leaks discovered in two residences. The overall trend shows decreasing water usage and costs. **Figure 7K** depicts historic water use and water costs from FY 2011 through FY 2016.

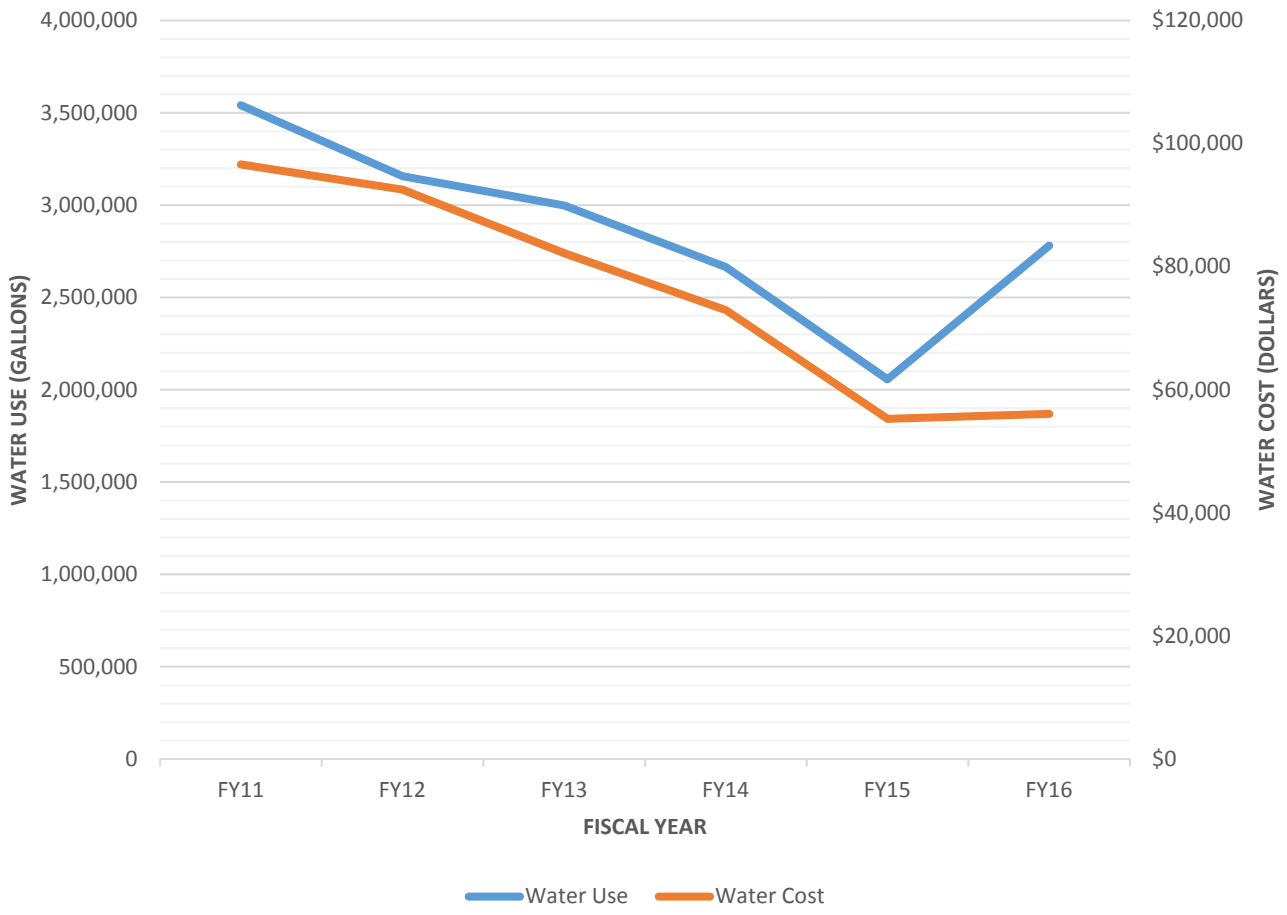

FIGURE 7K
Historic Water Use/Cost
Grand Canyon National Park Airport
Source: Airport records

Figure 7L depicts a breakdown of water use at the Airport from July 2014 to June 2016 by meter groups, which include the commercial tenants/town meters; ARFF station, administration building, and terminal meters; and residential meters. Residential water use is submetered, but ultimately paid for by the Airport. Currently, only one residential unit is using water for landscaping functions, but most of it goes toward showering, dishwashers, etc. The Airport does, however, encourage residential tenants to be

water-conscious. Section 12 of residential leases describes how much water each tenant can use in gallons/month, which varies based upon the number of occupants. If a tenant goes over the allotted amount, he/she is responsible for the overages.

According to the meter data, the commercial tenants/town meters represent most of the water use with approximately 59 percent of total water consumption for this time period. Residential meters represent 34.7 percent of water use over this time, with the ARFF station, administration building, and terminal meters representing 6.4 percent of water use. Notably, the residential meter use spiked in December 2015, which is when leaks were discovered in two residences.

Although the sale of water to the commercial tenants/town may be profitable, conservation practices for these entities should be considered as the usage increases the overall electric use (due to the pumping) and reduces the overall stored capacity of the water tanks for fire-suppression events.

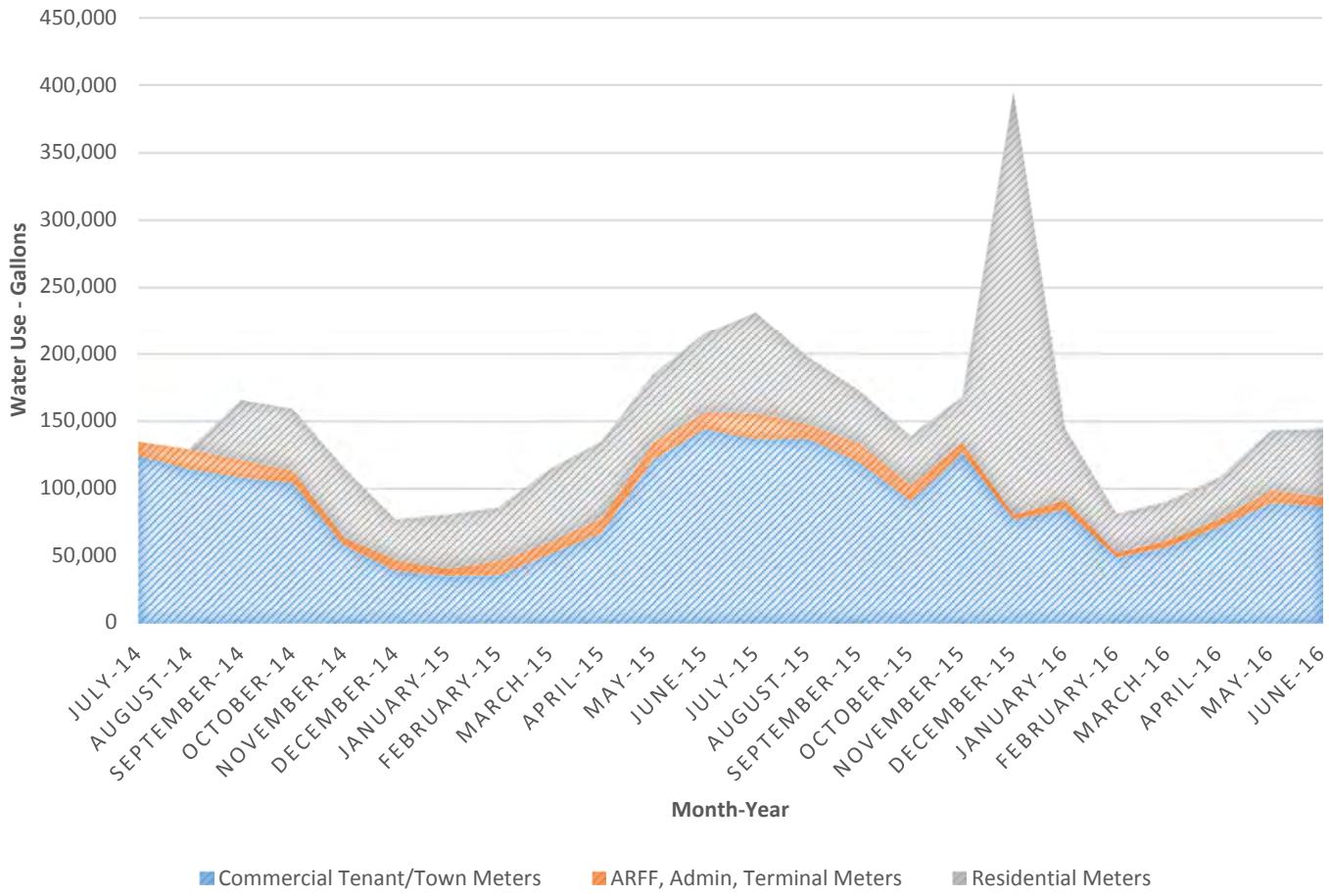

FIGURE 7L
Water Use by Meter
Grand Canyon National Park Airport
Source: Airport records

STORMWATER POLLUTION PREVENTION PLAN

A Stormwater Pollution Prevention Plan (SWPP) identifies all potential sources on-site that may impact stormwater quality discharges. The Airport maintains a current SWPPP as a part of its Arizona Pollutant Discharge Elimination System (AZPDES) industrial permit under the *Clean Water Act*.

RECOMMENDED UPGRADES

Existing Waste System
Source: Quest Energy Audit, 2016

The Energy Audit Report recommended several water savings measures that the Airport could employ to be more environmentally conscious and fiscally responsible. The most significant recommended upgrade, with the greatest financial return over time, is the investment of a new water distribution system. Currently, the terminal's water system room houses the pumping, control and treatment equipment to distribute water to the various buildings on Airport property. It involves a complicated delivery system with bi-annual water deliveries from Hydro-Resources. During delivery, water is pumped through an underground 375,000-gallon storage tank to the two storage tanks that sit on a hill above the administration building. This system could be simplified by using the existing pressure from the elevation of the storage tanks by transitioning to automated controls that regulate the release of water along with variable speed drives. This would maintain a constant water pressure and avoid the energy surges required to pump water up the hill during the recharge period bi-annually. For this to be an economical decision, the upgrade should only be considered with a larger system upgrade project.

Installing low-flow toilets and low-flow fixtures for shower heads and faucets is recommended for all the buildings that were audited. The current toilets have a water efficiency rating of 1.6 gallons per flush. Transitioning to low-flow toilets would provide substantial cost savings given the high cost of water. The low-flow fixtures would also allow for significant water savings. Currently, the faucets emit 2.2 gallons per minute. Replacing these fixtures with 0.5 gallons per minute aerators would provide a significant water savings at a minimal cost. Similarly, the current shower heads emit 2.5 gallons per minute, which could be reduced to 1.75 gallons per minute if they were placed with a low-flow option. **Table 7T** outlines these recommendations with the estimated initial costs, as well as long terms savings and payback period.

TABLE 7T
Recommendations with Cost and Savings Based on Existing Conditions
Grand Canyon National Park Airport

Measure	Existing Condition	Recommended Action	Initial Cost	Savings	Payback
TERMINAL BUILDING					
Water System	Complicated delivery system; equipped w/ two 20HP pumps & two 150 HP pumps	Use existing pressure from elevation of storage tanks & automated controls for water release & variable speed drives	$50,000	$5,394	9.27 yrs
Low-Flow Toilets	Toilets use 1.6 GPF	Use low-flow toilets	$2,800	$295	9.48 yrs
Low-Flow Faucet Aerators	Faucets emit 2.2 GPM	Replace current aerators	$80	$133	0.56 yrs
ARFF STATION					
Low-Flow Showers	Shower heads emit 2.5 GPM	Replace with low-flow option	$500	$295	1.69 yrs
Low-Flow Faucets	Faucets emit 2.2 GPM	Replace with low-flow aerators	$200	$144	1.39 yrs
ADMINISTRATION BUILDING					
Low-Flow Toilets	Toilets use 1.6 GPF	Use low-flow toilets	$200	$74	2.71 yrs
Low-Flow Faucets	Faucets emit 2.2 GPM	Replace aerators with low-flow aerators	$40	$35	1.15 yrs
ADDITIONAL USERS					
Residential Water Conservation	Airport pays for residential water use and landscaping	Replace showerheads & faucets to low-flow options; use xeriscaping practices	$6,600	$4,807	1.39 yrs

GPF: Gallons per flush
GPM: Gallons per minute
Source: Grand Canyon Airport Energy Audit Report, Quest Energy Group (June 2016)

POTENTIAL OPPORTUNITIES FOR PERFORMANCE IMPROVEMENT

- Place water conservation signs in all Airport restrooms that are provided for free from Coconino County as part of the County's water conservation initiatives.
- Re-establish the former rainwater containment system on a part of Airport property approved by the FAA.
- Continue use of the water conservation clause in the residential leases.
- Work with Coconino County, who offers free consultation regarding water conservation strategies, on how to implement grey water and reclaimed water use systems, as well as rainwater harvesting systems at the Airport.
- Replace faucets, toilets, and showerheads with low-flow options.
- Educate maintenance staff, employees, passengers, and tenants on water conservation strategies.

PART 2 – SUSTAINABILITY MANAGEMENT PLAN

SUSTAINABILITY GOALS AND OBJECTIVES

Part 1 of this chapter includes a baseline evaluation of current sustainability performance at GCN with accompanying opportunities for performance improvement. The information gathered in the Sustainability Baseline Assessment will serve as the foundation for the development of a series of goals, objectives, and initiatives the Airport can use to focus its sustainability efforts into the future. Part 2 will develop objectives and targets for each sustainability goal to provide metrics the Airport can use to evaluate progress, as well as a report card the Airport can use to stay on track during implementation. Parts 1 and 2 together will form an SMP that GCN can use as a guide to advancing sustainability.

The SMP is not intended to be a static document and should be routinely reviewed and updated to consider new opportunities and issues as they arise. While some of the sustainability objectives are one-off capital projects, others are programs that will operate continuously once implemented. To ensure the continued success of these programs, it will take buy-in from Aviation Department staff and, in some cases, tenants of GCN. Close coordination with all potential stakeholders is a key to the success of the program.

SUSTAINABILITY GOALS

This SMP is meant to complement and build upon the existing sustainability efforts of the Airport and the broader region. The goals identified for each sustainability focus category are intended to be broad and achievable, and not identify specific performance targets or milestones. This provides flexibility for the Airport to modify its program over time while maintaining the framework of these overarching goals. The goals for each sustainability focus category, summarized in **Table 7U**, are intended as a starting point for further discussion and consideration by the Airport, the Planning Advisory Committee (PAC), and the public.

TABLE 7U
Sustainability Goals
Grand Canyon National Park Airport

Sustainability Focus Categories	Goals
Air Quality	1. Improve regional air quality by reducing GHG emissions from GCN users and enacting policies to reduce emissions from Airport-controlled sources.
Energy	2. Expand energy efficiency measures and renewable energy opportunities.
Natural Resource Management	3. Incorporate procurement, landscaping, and janitorial practices that reduce the burden on nearby natural resources.
Land Use	4. Preserve surrounding natural resources by encouraging alternative transportation modes to and from the Airport, and reducing noise and light pollution caused by Airport activities.
Planned Development	5. Develop capital improvement projects that consider both present and future needs.
Construction Methods	6. Incorporate sustainability into Airport construction methods.
Resiliency and Preparedness	7. Protect the Airport from climate risks and cyber security threats.
Waste Management	8. Increase waste diversion rate through increased recycling and composting efforts.
Water	9. Reduce potable water consumption with expanded efficiency measures and reclaimed/grey water use.

SUSTAINABILITY OBJECTIVES AND INITIATIVES

An objective is a measurable step taken to achieve a goal.

For every sustainability goal, there are key objectives and initiatives that identify ways the Airport can meet its overarching goals. Sustainability objectives are more specific and can be measured using key performance indicators (KPIs). Initiatives are the individual projects that can be implemented by the Airport to achieve specific objectives. A list of sustainability objectives and initiatives are identified in **Table 7V** for each goal. This list was developed from a variety of sources, including the Sustainability Baseline Assessment, the Energy Audit Report from Quest, and a database of sustainable principles and practices maintained by the Sustainable Aviation Guidance Alliance (SAGA). SAGA is a coalition of aviation interests that formed in 2008 to assist airport operators in planning, implementing, and maintaining sustainability programs. Membership of SAGA is made up of many aviation/airport industry organizations, including the American Association of Airport Executives (AAAE), Airports Council International – North America (ACI-NA), Airport Consultants Council (ACC), FAA, Airlines for America (A4A), and various airport consultants. The database used for this evaluation consists of over 900 sustainability practices, including evaluation criteria based upon their applicability to EONS.

An initiative is one of several tools used to meet an objective.

TABLE 7V
Sustainability Objectives and Initiatives
Grand Canyon National Park Airport

Objectives	Initiatives
Goal 1. Improve regional air quality by reducing GHG emissions from GCN users and enacting policies to reduce emissions from Airport-controlled sources.	
1.1 Promote the reduction or elimination of idling vehicles in and around GCN. 1.2 Create an Airport vehicle fleet hybrid or alternative fuel replacement policy. 1.3 Achieve Airport Carbon Accreditation through a program administered by ACI. 1.4 Replace the HVAC system in the terminal building. 1.5 Encourage tenants to adopt flight procedures that use less fuel. 1.6 Improve indoor air quality in all Airport operated buildings.	• Post no idling signs in parking lots. • As vehicles and equipment are retired, promote the purchase of replacements with hybrid options or ones powered by alternative fuels. • Improve GHG reporting by aircraft, mobile, stationary sources, and waste management. • Educate tenants about limiting power-back and/or reverse thrust during flight procedures, de-rated take-off or thrust procedures, and using single/reduced engine during taxiing when authorized by the FAA. • Prohibit smoking within 25 feet of all entries, outdoor air intakes, and operable windows. • Identify potential indoor air pollutants, like CO, mold, asbestos, lead, or VOCs, and address their reduction.
Goal 2. Expand energy efficiency measures and renewable energy opportunities.	
2.1 Expand on-site solar PV systems. 2.2 Address energy efficiency in the design of all new or reconstructed Airport buildings. 2.3 Improve HVAC controls in all buildings. 2.4 Reduce costs related to inefficient lighting technology. 2.5 Reduce energy costs associated with water pumping.	• Add a 30kW solar PV system to the terminal building and an additional 35kW to the ARFF station. • Adopt the International Energy Conservation Code as a minimum design and construction standard. • Upgrade to thermostats that allow remote access and scheduling. • Replace all incandescent and halogen fixtures with LED technology (including runway and entrance lighting). • At the next remodel, update the controls and re-design the water distribution system to rely on passive energy.
Goal 3. Incorporate procurement, landscaping, and janitorial practices that reduce the burden on nearby natural resources.	
3.1 Formalize landscape management practices. 3.2 Incorporate sustainability into procurement policy. 3.3 Incorporate green cleaning methods and products into janitorial practices.	• Eliminate the use of herbicides and pesticides. • Incentivize local material sourcing in procurement policy, and order supplies and equipment in bulk to reduce packaging waste. • Prioritize the purchase of products with certified eco-labels, such as USDA Organic or Forest Stewardship Council certified. • Pursue LEED O&M certification to green internal building and janitorial practices.
Goal 4. Preserve surrounding natural resources by encouraging alternative transportation modes to and from the Airport, and reducing noise and light pollution caused by Airport activities.	
4.1 Reduce the number of trips to GCN in cars/personal vehicles. 4.2 Minimize and manage ambient noise and light levels to protect the integrity of the Kaibab National Forest and GCNP.	• Promote existing walking trails as viable transportation sources to and from the Airport for visitors and employees. • Work with the Town of Tusayan to incorporate an Airport stop to the Tusayan Park and Ride Shuttle. • Adhere to the standards of the International Dark Sky Parks certification to complement lighting goals and efforts of GCNP.

TABLE 7V (Continued)
Sustainability Objectives and Initiatives
Grand Canyon National Park Airport

Goal 5. Develop capital improvement projects (CIPs) that consider both present and future needs.	
5.1 Concentrate development on previously disturbed lands. 5.2 Support Tusayan's Airport CIPs, including the Town Hall and employee housing initiatives. 5.3 Integrate sustainability into all Airport planning documents and contracts.	• Incorporate sustainability goals and objectives into the Airport and Tusayan CIP budget process. • Development sustainability language to be incorporated into tenant leases. • Create and incorporate contract language requiring sustainable practices for future development projects.
Goal 6. Incorporate sustainability into Airport construction methods.	
6.1 Tie contractor and vendor documentation of sustainable practices to payments to ensure compliance. 6.2 Reduce waste related to construction and demolition. 6.3 Prioritize green construction methods over conventional construction practices.	• Source materials locally/regionally as available. • Apply for green building awards through Coconino County's Sustainable Building Program. • Develop and implement a construction waste management plan. • Require LEED certification (or other green building standard or green construction code) for all Airport construction (new and existing). • Reuse existing structures and building components, or recycle building materials that cannot be repurposed.
Goal 7. Protect the Airport from climate risks and cyber security threats.	
7.1 Transition to an adaptive management style in Airport planning to design and plan for features that are easily altered given future climate impacts. 7.2 Formalize the Airport's policies related to climate change. 7.3 Partner with Tusayan and GCNP to develop regional climate change goals. 7.4 Ensure existing Airport planning documents are up to date. 7.5 Identify Airport cyber-related vulnerabilities.	• Conduct a resiliency and preparedness study to address areas where the Airport is vulnerable to climate and cyber threats. • Document identified cyber security threats and address the measures needed to achieve the appropriate level of protection. • Create and adopt an Airport climate change adaptation plan or climate change action plan that complements the GCNP Action Plan. • Regularly update the Airport Certification Manual, Emergency Rescue Grid Map, Airport Emergency Plan, and Snow and Ice Control Plan.
Goal 8. Increase waste diversion rate through increased recycling and composting efforts.	
8.1 Conduct regular waste audits. 8.2 Increase passenger awareness of recycling opportunities at the Airport. 8.3 Implement a composting program that accepts more than just chip trees and horse manure. 8.4 Decrease vehicle miles traveled by solid waste and recycling provider.	• Collaborate with tenants to consolidate solid waste and recycling efforts. • Place signs throughout Airport managed buildings and tenant facilities that explains what can/cannot be recycled. • Place recycling bins in Airport management offices and tenant buildings for uncommon items (batteries, printer cartridges, electronics, etc.). • Collect food scraps from tenants, passengers, and residences to incorporate into existing composting efforts. • Request a quote for solid waste and recycling from competing waste service providers to potentially lower costs and decrease vehicle miles traveled to Tusayan area for solid waste and recycling. • Reduce unnecessary dumpster pickups by only scheduling service when recycling and waste containers are at capacity.

TABLE 7V (Continued)
Sustainability Objectives and Initiatives
Grand Canyon National Park Airport

Goal 9. Reduce potable water consumption with expanded efficiency measures and reclaimed/grey water use.	
9.1 Support Coconino County in its efforts to use reclaimed and/or gray water for landscaping functions. 9.2 Involve employees, tenants, and passengers in water conservation efforts. 9.3 Upgrade infrastructure to reduce water consumption per Quest recommendations.	• Place water conservation signs in all Airport restrooms, which are provided for free from Coconino County. • Continue the use of the water conservation clause in the residential leases. • Provide educational trainings and materials to employees, passengers, and tenants regarding water conservation strategies. • Replace faucets, toilets, and showerheads with low-flow options. • Re-establish the former rainwater containment system on a part of Airport property approved by the FAA. • Incorporate rainwater harvesting systems into new airport buildings including the proposed new terminal building.

SUSTAINABILITY PERFORMANCE TARGETS

To ensure ADOT can measure the Airport's sustainability performance and continually drive progress toward achieving the identified sustainability goals and objectives, quantifiable performance targets, or KPIs, are necessary. KPIs are the specific, results-based metrics that allow GCN to gauge sustainability performance. If KPIs are trending positively toward the overall goal, this indicates the specific initiatives that have been put into place are producing desired results; however, if KPIs trend negatively, then this is an indication that the Airport needs to refocus on that specific area and identify opportunities for improvement. Most KPIs should be tracked on a regular (monthly/quarterly/yearly) basis so that trends can be identified regarding program performance.

Sustainability performance targets and KPIs are outlined in **Table 7W**. The primary intent of this effort is to set targets that are realistic and achievable, while pushing the Airport to make significant strides toward improving the sustainability performance of GCN.

TABLE 7W
Sustainability Performance Targets
Grand Canyon National Park Airport

Targets	Key Performance Indicators (KPIs)
Goal 1. Improve regional air quality by reducing GHG emissions from GCN users and enacting policies to reduce emissions from Airport-controlled sources.	
1. Achieve Airport Carbon Accreditation. 2. Prepare annual GHG emissions report. 3. Transition Airport vehicles and GSE to all hybrid (or other alternative fuel) options. 4. Adopt no idling policy on Airport property. 5. New HVAC system in the terminal building that brings in 100% outside air (when conditions allow). 6. All tenants adopt flight procedures that use less fuel.	• Level of Airport Carbon Accreditation received (1, 2, or 3) • GHG emissions/year (in CO_2e) • Number of alternative fuel/low-emission fleet vehicles • Number of no-idling signs • Number of tenants that adopt fuel reduction strategies

TABLE 7W (Continued)
Sustainability Performance Targets
Grand Canyon National Park Airport

Goal 2. Expand energy efficiency measures and renewable energy opportunities.	
1. Add an additional 35kW solar PV system to ARFF station. 2. Add a 30kW solar PV system to the terminal building. 3. Install solar powered lighting fixtures on north and south entrance lights. 4. Transition all indoor lighting fixtures to LEDs. 5. Reduce unwanted outdoor air infiltration in terminal building. 6. Replace thermostats and re-program to heat/cool in 15-minute intervals. 7. Replace water delivery system. 8. Replace air conditioning unit with heat pumps.	• Number of kW/year from solar PV systems • Number of buildings with LED light fixtures • Energy cost (kWhs/month or year) • Energy use (kWhs/month or year)
Goal 3. Incorporate procurement, landscaping, and janitorial practices that reduce the burden on nearby natural resources.	
1. Eliminate the use of herbicides and pesticides for pest management. 2. Establish a green procurement program. 3. Establish a green cleaning program.	• Number of buildings that use herbicides or pesticides • Annual expenditures on sustainable and locally sourced materials • Number of cleaning products certified by an eco-label (i.e., Green Seal, USDA BioPreferred, etc.)
Goal 4. Preserve surrounding environment by encouraging alternative transportation modes to and from the Airport, and reducing noise and light pollution caused by Airport activities.	
1. Add an Airport stop on the Tusayan Park and Ride Shuttle route. 2. Advertise existing walking trails to Airport for visitors and employees. 3. Comply to the International Dark-Sky standards (in accordance with the International Dark-Sky Association) to complement GCNP's efforts.	• Number of average daily vehicle trips to the Airport • Number of days the parking lot reaches capacity • Percent of alternative transportation modes used by staff, visitors, and passengers to and from GCN (i.e., walking, bicycling, bus)
Goal 5. Develop capital improvement projects (CIPs) that consider both present and future needs.	
1. Construct sustainable and regional CIPs 2. Establish sustainable Airport planning documents and contracts.	• Number of development projects with sustainable element • Number of development projects that consider Tusayan CIPs • Number of contracts/documents that consider sustainability (including contractor documents) • Capital expenditures on projects with sustainable elements
Goal 6. Incorporate sustainability into Airport construction methods.	
1. Reduce construction and demolition waste. 2. Establish a green construction policy. 3. Source 50% of all construction materials locally/regionally	• Volume of construction and demolition waste • Number of buildings with green elements • Number of locally/regionally sourced materials • Number of green building awards awarded by Coconino County's Sustainable Building Program

TABLE 7W (Continued)
Sustainability Performance Targets
Grand Canyon National Park Airport

Goal 7. Protect the Airport from climate risks and cyber security threats.	
1. Adopt an Airport Climate Action Plan. 2. Annual update of Airport emergency planning documents. 3. Reduce the number of cyber security related threats.	• Cost of extreme events to the Airport annually (i.e., replacing pavement more than normal, fire support, etc.) • Number of education/training events related to resiliency • Number of annual cyber security threats • Annual check for updates on the Airport Certification Manual, Emergency Rescue Grid Map, Airport Emergency Plan, and Snow and Ice Control Plan[1]
Goal 8. Increase waste diversion rate through increased recycling and composting efforts.	
1. Decrease vehicle miles traveled by solid waste and recycling provider. 2. Conduct annual waste audit. 3. Reduce volume of waste sent to the landfill. 4. Increase passenger awareness of recycling opportunities at the Airport.	• Annual check on waste audit completion[2] • Weight of waste sent to the landfill • Annual cost of recycling and solid waste services • Number of tenants that recycle • Number of signs in Airport managed buildings that explain what can/cannot be recycled. • Number of recycling bins in Airport management offices and tenant buildings for uncommon items • Weight of food scraps collected from tenants, passengers, and residences • Vehicle miles travelled by solid waste and recycling provider(s) • Number of annual solid waste and recycling pick-ups
Goal 9. Reduce potable water consumption with expanded efficiency measures and reclaimed/grey water use.	
1. Replace all showerheads, faucets, and toilets with low-flow options. 2. Reduce potable water consumption. 3. Increase on-site rainwater catchment capacities.	• Amount of potable water used (gallons) • Annual water costs ($/gallon) • Number of water conservation signs in Airport restrooms • Number of tenant leases with water conservation clause (as currently exists in the residential leases) • Number of educational trainings held for employees and tenants regarding water conservation • Number of faucets, toilets, and showerheads with low-flow options • Amount of harvested rainwater used (gallons)

[1] Not included on score card as this is something the Airport should do annually regardless of sustainable KPIs
[2] Not included on score card as this is a static measure that would not quantifiably change from year-to-year

SUSTAINABLE OBJECTIVES MATRIX

Short-term objectives are those that can be immediately or quickly implemented at the Airport to reach the sustainability objective. Generally, short-term goals are considered achievable within one to five years. Sustainability objectives that are classified as long-term are those that the Airport should plan for in the future, approximately six or more years. An evaluation of the objectives outlined have been prepared using the SAGA database of sustainable practices, as well as information provided in the Energy

Audit Report done by Quest in June 2016. **Exhibit 7B** examines the impact of each sustainability objective by applying the following seven criteria:

- Upfront capital investment to plan, design, and construct the project;
- Estimated annual operation and maintenance (O & M) costs;
- Payback period for a return on the initial capital investment;
- Staffing requirements in terms of hours required per month to implement or operate the practice;
- Energy reduction of how the project will impact the amount of fossil fuels and/or building electricity consumed;
- Natural environmental benefits that result from the project; and
- How the project affects society and employee well-being.

Exhibit 7B also indicates which sustainability categories are positively impacted by each goal. For instance, a redesign of the water distribution system would conserve water and reduce energy consumption, thus representing benefits to both the water and energy sustainability baseline categories. Further, to represent the SMP's relevance to the broader region, objectives consistent with those outlined in the GCNP Action Plan are also indicated.

EVERYDAY SUSTAINABILITY

Successful implementation of the objectives included in **Exhibit 7B** rely on key Airport staff integrating sustainability into everyday business decisions such that sustainability is not seen as an add-on, but rather viewed as the critical path to creating value for the Airport financially, environmentally, and socially. To ensure buy-in from all staff, it is important to distribute the accountability across all employees so that everyone feels responsible for identified tasks that help the Airport meet a larger sustainability goal. Staff at GCN includes the following positions:

- Airport Manager
- Airport Operations Manager
- Administrative Supervisor
- ASO 1/Airport Finance Specialist
- Fire Fighter Supervisor
- Airport Firefighter I
- Airport Firefighter II

Although all positions are important, those in management positions are especially crucial as they set the tone for sustainability at an airport. A manager is responsible for setting policies and overall sustainability goals for an airport, as well as promoting sustainability in daily activities. Key roles of a management position at an airport include the following:

- Establishing overall sustainability objectives, goals, and policies
- Providing resources to staff and airport users that support sustainability strategies

SUSTAINABLE OBJECTIVE EVALUATION	INITIAL INVESTMENT	O & M[1] COST	PAYBACK PERIOD	STAFFING REQUIREMENTS	ENERGY REDUCTION	ENVIRONMENTAL BENEFITS	SOCIAL BENEFITS	CATEGORIES IMPACTED	CORRESPONDING GCNP OBJECTIVES
SHORT-TERM OBJECTIVES									
Prohibit smoking within 25 feet of all entries, outdoor air intakes & operable windows					N/B				N/A
Implement anti-idling measures for all vehicles (incl. GSE) within Airport environs									"Implement a no-idling policy."
Post occupancy signs on roads & in parking areas to reduce emissions related to wayfinding									"Provide advanced warning of parking conditions."
Receive free training from Coconino County on how to conserve water					N/B	N/B			N/A
Place aerators on all faucets & showerheads									"Replacement of low-flow fixtures is ongoing."
Replace toilets with low-flow options									"Replacement of low-flow fixtures is ongoing."
Place water conservation signs in all restrooms[2]									N/A
Place signs throughout buildings explaining what can/cannot be recycled					N/B				"Institute signage throughout the park and weave waste reduction messaging into interpretation programs."
Recycle uncommon items (i.e., batteries, ink cartridges)					N/B				"Establish a program for printer ink and toner refills."
Consolidate recycling & solid waste efforts with tenants									N/A
Collect food scraps for pick up or incorporate into existing chip trees & manure compost									"Compost food and other organic waste."
Reduce unnecessary dumpster pickups by scheduling service when dumpsters are full					N/B	N/B	N/B		N/A
Request a quote for solid waste & recycling from multiple solid waste providers					N/B	N/B	N/B		N/A
Apply for awards from Coconino County Sustainable Building Program					N/B	N/B			N/A
Incentivize alternative transportation methods (i.e., hiking, biking, walking)									"Promote visitor use of trails for alternative means of travel."
Adhere to International Dark Sky Parks certification standards									"Install dark-sky comliant lighting in compliance with Park Lighting Guidelines."
Incorporate sustainability into procurement policy					N/B				"Reviewing concessioner contractual language to include sustainble practice requirements."
Implement a Natural Resources Management Plan (incl. reduction or elimination of toxic pesticide use)					N/B				N/A
Adopt the International Energy Conservation Code for new or reconstructed buildings									N/A
Upgrade all light fixtures to LEDs							N/B		"Upgrade all light bulbs and fixtures to energy-efficient bulbs."
Add secondary doors or air curtains to terminal building							N/B		N/A
Upgrade &/or re-program all thermostats to maximize energy efficiency							N/B		"Upgrade to programmable thermostats."
Publish voluntary standard operating procedures for more energy-efficient flight procedures									N/A
Require GHG reporting by aircraft, mobile, stationary sources & waste management									N/A
Use existing operable windows in place of the HVAC system when the temperature allows							N/B		N/A

ARFF: Aircraft Rescue and Fire Fighting
FAA: Federal Aviation Administration
GCNP: Grand Canyon National Park
GHG: Greenhouse gas
GSE: Ground support equipment
HVAC: Heating, ventilation, and air conditioning
LED: Light-emitting diode
LEED: Leadership in Energy and Environmental Design
N/A: Not Applicable
N/B: No Benefit
PV: Photovoltaic

Symbol Key On Back

Source: SAGA Sustainable Practices Database (November 2016), Quest Energy Group (June 2016) [1] O & M: Operations and Maintenance [2] Signs provided for free from Coconino County as part of the County's water conservation initiatives

SUSTAINABLE OBJECTIVE EVALUATION	INITIAL INVESTMENT	O & M[1] COST	PAYBACK PERIOD	STAFFING REQUIREMENTS	ENERGY REDUCTION	ENVIRONMENTAL BENEFITS	SOCIAL BENEFITS	CATEGORIES IMPACTED	CORRESPONDING GCNP OBJECTIVES
LONG TERM OBJECTIVES									
Adopt an adaptive management style to airport planning	2	2	2	3	N/B	2	3	Planned Development, Land Use	"Incorporate climate change into all planning efforts and documents."
Adopt a climate change action plan	2	1	1	2	1	2	3	Air Quality	GCNP adopted a climate action plan in 2009.
Create & implement a construction waste management plan	2	2	2	2	1	3	N/B	Construction Methods, Planned Development	"Implement a Construction Waste Management Plan."
Source construction materials locally or regionally	2	1	1	1	N/B	2	1	Construction Methods, Planned Development	N/A
Create & incorporate sustainable contract & bid language	1	1	1	1	1	2	1	Planned Development	"Incentivize contractors to practice green purchasing."
Require all new or reconstructed developments to achieve LEED certification, Green Globes Program, or Living Building Challenge	2	3	1	2	2	3	1	Land Use, Planned Development	"Ensure that 100% new construction meets LEED certification standards."
Expand Park & Ride shuttle to the Airport	2	2	1	1	1	2	1	Air Quality, Energy, Land Use	"Evaluate opportunities to expand current alternative fuel shuttle buses to areas of heavy use and traffic."
Create compact, walkable future airport developments	1	1	1	1	1	2	1	Construction Methods, Land Use, Planned Development	N/A
Conduct regular waste audits	2	2	2	2	N/B	3	2	Waste Management	N/A
Achieve LEED O&M certification for Airport buildings	2	3	1	2	N/B	3	1	Energy, Land Use	"Develop schedule to bring existing buildings into LEED Existing Buildings Operations and Maintenance system when possible."
Install bottle refill stations	2	1	2	1	N/B	2	1	Energy, Water	N/A
Add a 30kW solar PV system to the terminal building and 25kW solar PV system to ARFF station	2	2	4	1	2	2	2	Air Quality, Energy	"Purchase 100% renewable energy-generated electricity."
Add insulation to the exterior walls of the terminal building	2	1	4	1	1	2	1	Energy	N/A
Redesign the water distribution system & upgrade the controls	2	1	3	1	1	1	N/B	Energy, Water	N/A
Upgrade the HVAC system in the terminal building	2	1	2	1	1	2	N/B	Air Quality, Energy	N/A
Achieve Airport Carbon Accreditation Level 1 or 2	1	1	1	1	2	2	2	Air Quality, Energy	N/A
Replace retired vehicles with hybrid options (or other alternative fuel)	3	2	3	1	2	2	N/B	Air Quality, Energy	"Evaluate opportunity to replace conventional vehicles with alternative fuel vehicles including hybrid electric vehicles, electric vehicles, compressed natural gas, and biodiesel."
Re-establish former rain water containment system on FAA-approved part of the airport	2	2	2	1	N/B	1	1	Water	N/A
Conduct a resiliency & preparedness study to address where Airport is vulnerable to climate and cyber threats.	1	1	1	1	N/B	1	1	Resiliency	"Conduct applicable vulnerability assessments."

KEY

Initial Investment
1 – < $5,000
2 – $5,000 to $100,000
3 – $100,000 to $500,000
4 – > $500,000

O & M Cost
1 – < $5,000 (savings)
2 – $5,000 to $50,000
3 – $50,000 to $100,000
4 – > $100,000

Payback Period
1 – 0 to 2 years
2 – 2 to 5 years
3 – 5 to 15 years
4 - > 15 year

Staffing Requirement
1 – < 10 hours per month
2 – 10-50 hours per month
3 – 50 – 200 hours per month

Energy Reduction
N/B – No benefit
1 – Decreases consumption
2 – Decreases consumption & generates renewable

Environmental Benefits
N/B – No benefit
1 – Low benefit
2 – Moderate benefit
3 – Multiple benefits

Social Benefits
N/B – No benefit
1 – Low benefit
2 – Moderate benefit
3 – Multiple benefits

Air Quality · Energy · Land Use · Planned Development · Natural Resource · Construction Methods · Resiliency · Waste Management · Water

Source: SAGA Sustainable Practices Database (November 2016), Quest Energy Group (June 2016)

- Establishing incentives and rewards to encourage sustainability efforts
- Monitoring sustainability and environmental progress at and around the airport
- Communicating with stakeholders
- Foster and promote sustainable practices

Another critical role in everyday sustainability are administrative and financial personnel. These roles are fundamental in the facilitation and upkeep of the sustainability program. These roles establish green procurement criteria and ensure other staff members adhere to the sustainable purchasing guidelines. Those responsible for managing the budget may not directly perform green activities, but are crucial in the allocation of funding and ensuring there are sufficient funds from year to year for new and ongoing sustainability efforts.

Although these roles do not administer the sustainable initiatives, he/she is responsible for funding all efforts related to procurement. This role ensures that sustainable purchasing practices are constantly followed, as well as monitoring annual spending as it relates to green projects.

FUNDING SOURCES

Financing for the sustainable airport projects and programs can come from various federal, state, and local sources, as outlined below.

AIP GRANT FUNDING

At the federal level, the FAA provides funding to airports through the Airport Improvement Program (AIP). Sustainability projects available for AIP grant funding are discussed below.

FAA Voluntary Airport Low Emissions (VALE) Program[20]

The FAA's VALE program is designed to reduce all sources of airport ground emissions to meet the responsibilities of the *Clean Air Act*. Through the VALE program, airports can use AIP funds and Passenger Facility Charges (PFCs) to purchase low emission vehicles, refueling and recharging stations, gate electrification, and other air quality improvements. VALE funding is currently only available to commercial service airports that are located within areas designated by the Environmental Protection Agency (EPA) as being in non-attainment or maintenance of National Ambient Air Quality Standards (NAAQS). GCN does not currently qualify for the VALE program as Coconino County is in attainment for all regulated pollutants; however, should the County ever exceed federal limits, the Airport would be qualified for VALE Program funds.

[20] More information at: http://www.faa.gov/airports/environmental/vale/

Zero Emissions Vehicle and Infrastructure Pilot Program[21]

The FAA's Zero Emissions Vehicle (ZEV) and Infrastructure Pilot Program provides funding to any AIP-eligible airport for AIP grants for the acquisition and operation of ZEVs, including the construction or modification of infrastructure to facilitate the delivery of fuel and services necessary for the use of such vehicles. This program will allow for public access to the refueling/recharging stations under certain conditions. The conditions, as outlined in Table 5 of the *Zero Emissions Airport Vehicle and Infrastructure Pilot Program – Technical Guidance, Version 1* (2012), are as follows:

1. Ninety percent of the funded refueling or recharging station capacity is dedicated for on-airport vehicle use. Therefore, only 10 percent of the funded refueling or recharging station capacity can be available for public use.
2. The sponsor must guarantee security and public safety.
3. The sponsor must charge a reasonable fee for the use of the facility. Fees are considered airport revenue.
4. Sponsor vehicles must have priority use of the facility, especially in the event of fuel shortages or emergencies.
5. The sponsor must clearly document the number of project ZEVs and public ZEVs that will access the facility.
6. Sponsors must provide letters of commitment to FAA from non-airport ZEV owners at the time of grant application to support their proposed facility use plans. The sponsor must not unreasonably deny access or unjustly discriminate against users requesting access to these federally funded airport facilities.

Program to Increase Energy Efficiency of Airport Power Sources[22]

Section 512 of the FAA *Modernization and Reform Act of 2012* made projects that increase the energy efficiency of airport power sources eligible for AIP funding (Chapter 6, Section 7 of the FAA AIP Handbook). This legislation encourages airports to assess their energy requirements, including heating and cooling, base load, back-up power, and power for on-road airport vehicles and ground support equipment, all to increase energy efficiency at the airport. Based on the results of an energy assessment/audit, funds can be made available to acquire or construct equipment that will increase energy efficiency at the airport. Examples of projects include:

- On-airport power generation for electricity and heating/cooling (i.e., solar, geothermal, hydrogen powered electrical energy generation)
- Stand-alone energy efficiency upgrades in an AIP-eligible airport facility (i.e., HVAC, hot water heater, and energy efficient lighting)

[21] More information at: http://www.faa.gov/airports/environmental/zero_emissions_vehicles/
[22] More information at: https://www.faa.gov/airports/aip/aip_handbook/media/AIP-Handbook-Order-5100-38D.pdf

- Replacement of stationary ground support equipment
- Replacement of airport-owned vehicles[23]

Energy Efficiency (Green/Sustainable) Improvement Costs[24]

Funding through the AIP program is available for projects to improve the energy efficiency of a building. The criteria for energy efficiency improvement costs, as detailed in Table 3-44 of the FAA AIP Handbook, are as follows:

a. The cost must be incurred on a measure to improve the efficiency of an airport building (such as a measure designed to meet one or more of the criteria for being considered a high-performance green building as set forth under Section 401(13) of the *Energy Independence and Security Act of 2007*).
b. Any increases in initial project costs must be offset by expected savings over the life cycle of the project. The sponsor must follow the published FAA guidance for calculating the life cycle cost.
c. For building projects, the cost must be incurred on an otherwise eligible and justified airport building project (improving energy efficiency cannot be the justification). A project to improve a building's energy efficiency is not eligible as a stand-alone project.
d. The cost must only include costs which are necessary for the project, such as those for design, construction, testing, and inspection (not for obtaining LEED or similar certification or credits – which is not a necessary cost of the project).
e. For a building, which contains eligible and ineligible areas, all costs associated with the measure (such as design, construction, testing, and inspection) must be prorated accordingly.
f. The sponsor must submit the initial project costs, the expected savings over the life of the project, the life cycle cost calculations, and the proration calculations (for buildings that contain eligible and ineligible areas) to the ADO.

NON-AIP FUNDING SOURCES

The FAA's Airport Cooperative Research Program (ACRP) Synthesis 24, *Strategies and Financing Opportunities for Airport Environmental Programs,* provides a comprehensive summary of funding sources for not only environmental studies and mitigation projects but also for sustainable practices. This report identified several Arizona state programs that provide funding for environmental or sustainability projects, one of which GCN would be eligible for:

[23] http://www.airport-energy.org/presentations/FAA-Funding_Energy_Programs_at_Your_Airport_by_Patrick_Magnotta.pdf
[24] More information at: https://www.faa.gov/airports/aip/aip_handbook/media/AIP-Handbook-Order-5100-38D.pdf

- Arizona Department of Environmental Quality Targeted Watershed Improvement Projects – Provides grants with a 40 percent local match for projects that are required for compliance under the NPDES or AZDES.
- Arizona Department of Transportation, Aeronautics Division, Airport Grants and Loan Program – Provides grants with a 50 percent local matching share of the AIP funded project for planning and development projects that involve environmental mitigation.

Local funding sources should also be explored for sustainable projects. According to ACRP Synthesis 24, regional utility companies often offer a variety of financial assistance and incentive programs to encourage the reduction of fossil fuel-based energy consumption. Local and regional planning agencies may also be a source of funding. GCN's electric provider, Arizona Public Service (APS), collaborated with National Bank of Arizona to offer low interest rate financing to customers applying for rebates. In addition to this partnership, APS offers several rebate programs for business customers looking to upgrade their building envelope (windows, glass doors); HVAC equipment; information technology; lighting; variable speed drives and motors; pumps and blowers; refrigeration; thermostats and energy controls; and whole-building design. In addition to these standard rebate projects, APS will work with clients on custom rebates programs if the energy savings are justified. APS will pay a rebate of $0.11 kWh saved in the first year, up to 75 percent of the incremental cost.[25]

Third-Party Financing

Third-party financing is another option for sustainability projects in which agreements are reached between the airport and a private business, which then can construct on-airport facilities. The ACRP Synthesis 24 gives two examples of this agreement. In one example, a private business invests in the construction of an on-airport compressed natural gas (CNG) refueling station (at no cost to the airport), because of the potential profits from CNG fuel sales. This is a guaranteed energy savings contract (GESC) model based on the concept that third-party providers can earn a profit by selling and installing efficient and renewable energy devices while being reimbursed from the reduction in electric utility costs. In another example, a private business offers to perform solid waste reduction, reuse, and recycling services for airports at no charge, based on the potential revenue stream generated by the sale of recyclable materials. Depending on the type and volume of materials, airports may even generate net revenue from these types of arrangements.

The following is a detailed description of a typical GESC process as provided in ACRP Synthesis 24:

1. The energy services company (ESCO) conducts a comprehensive energy analysis or audit of the facilities and develops recommendations to improve energy efficiency or otherwise reduce energy consumption.
2. The ESCO develops a GESC offer in which it (1) estimates the energy costs savings that will be achieved if the recommendations are followed, (2) guarantees that the savings will be obtained

[25] https://www.aps.com/en/business/savemoney/solutionsbyequipmenttype/Pages/home.aspx

if the ESCO is retained to implement the recommendations, and (3) agrees to be compensated for its work in implementing the recommendations through the energy savings achieved by the facility owner.

3. The ESCO and facility owner execute the GESC.

Other options for third-party financing of sustainability projects, such as solar energy generation projects, include power purchase agreements (PPAs) and solar leases. Under a PPA, the ESCO builds the solar energy system on the airport at no cost to the airport sponsor. The solar energy system offsets the airport's electric utility bill and the ESCO sells the power generated to the airport at a fixed rate, which is often lower than standard. At the end of the contract term, PPAs can be extended or the sponsor can buy the solar energy system. A lease model is no different than lease agreements for automobiles. A contract is established between the airport sponsor and the ESCO to pay for a solar energy system over several years with the option to purchase the system before the end of the lease term. These third-party funding options can be considered for on-site renewable energy generation projects as they alleviate the Aviation Department from investing large up-front capital costs.

SUSTAINABILITY MONITORING PROGRAM

Routine monitoring of the sustainability program by GCN staff will be necessary to measure program performance. Understanding the positive and negative results of program implementation will allow GCN staff to determine if the airport is progressing toward its overall sustainability goals or if adjustments should be made.

To support GCN in this data collection and analysis process, a Sustainability Report Card has been created. The Sustainability Report Card, included as **Exhibit 7C**, is designed to compare the reporting year status to a baseline case – year 2015 – and then outline improvements from the previous year's data. The second page of the Report Card allows staff to report on any issues, challenges, and lessons learned in its sustainability program. As a living document, the sustainability plan needs to be monitored on a regular basis. The Sustainability Report Card serves as a continuous monitoring device to summarize lessons learned, issues that arise, and opportunities for improvement. The Sustainability Report Card can also serve as a means for promoting the Airport's sustainability efforts and performance to the public.

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SUSTAINABILITY PLAN SUMMARY

The sustainability plan includes a baseline evaluation of current sustainability performance at the Airport. GCN has already incorporated many sustainable programs and facilities, including on-site electricity generation and xeriscaping practices, and a LEED Gold-certified aircraft rescue and firefighting facility

SUSTAINABILITY PERFORMANCE TARGETS	KEY PERFORMANCE INDICATORS	REPORTING YEAR STATUS	BASELINE YEAR DATA	IMPROVEMENT FROM BASELINE YEAR	IMPROVEMENT FROM PREVIOUS YEAR
Air Quality	Airport Carbon Accreditation status & level		N/A		
	GHG emissions (tons/year)[1]		11,393		
	# of alternative fuel/low-emission fleet vehicles		0		
	# of "No Idling" signs in parking lots[2]		0		
	# of tenants that adopt fuel reduction strategies		0		
Energy	Energy use (kWhs/year)[3]		510,582		
	# of buildings with LED light fixtures		0		
	On-site energy generation (kWhs/year)[4]		7,022		
	Energy costs ($/year)		78,989		
Natural Resource Management	# of buildings that use herbicides or pesticides		20		
	Annual expenditures on sustainable & locally sourced materials		0		
	# of cleaning products certified by an eco-label		0		
Land Use	# of average daily vehicle trips to the Airport[5]		300		
	# of days the parking lot reaches capacity		Baseline Unknown		
	% of alternative (bus, bike, walk) transportation used by staff/visitors/passengers to & from GCN		20		
Planned Development	# of development projects with sustainable elements		0		
	# of development projects that consider Tusayan CIPs		0		
	# of contracts/documents that include sustainable elements		0		
	Capital expenditures on projects with sustainable elements		0		
Construction Methods	Volume of construction and demolition waste (cubic yards/year)		Baseline Unknown		
	# of buildings with green elements		1		
	Expenditures for locally/regionally sourced materials ($/year)		Baseline Unknown		
	# of green building awards from Coconino County's Sustainable Building Program		1		
Resiliency & Preparedness	Cost of extreme events to Airport ($/year)		0		
	# of resiliency training/education events		0		
	# of annual cyber security threats		0		
Waste Management[6]	Weight of waste sent to the landfill (tons/year)		1,378		
	# of tenants that recycle		Baseline Unknown		
	# of recycling signs in Airport managed buildings		0		
	# of recycling bins for uncommon items (i.e. batteries)		0		
	Weight of food scraps collected from tenants, passengers & residences (pounds)		0		
	Roundtrip vehicle miles traveled by solid waste & recycling provider(s) (miles/pick-up)[7]		470		
	# of annual solid waste & recycling pick-ups[8]		78		
	Cost of recycling & solid waste services ($/year)		8,800		
Water[9]	Amount of water used (gal/year)		2,621,623		
	Annual water costs ($/year)		82,715		
	# of water conservation signs in Airport restrooms		0		
	# of tenant leases with water conservation clause		23		
	# of educational trainings held for employees & tenants regarding water conservation		0		
	# of faucets, toilets & shower heads with low-flow options		0		
	Amount of harvested rain water (gallons/year)		0		

Were there any issues or challenges implementing any of the Sustainability Performance Targets? (e.g., Additional staffing, funding needed, etc.)

List any lessons learned or best practices for implementation in the following reporting year.

Include/attach any pertinent data that complements the Report Card for record keeping purposes.

[1] Greenhouse gases (GHGs) include CO_2, CH_2, N_2O, and CO_2e calculated using the Airport Carbon and Emissions Reporting Tool (ACERT)
[2] As a static measure, this can be removed once signs are placed in parking lot
[3] Energy use includes electric only (natural gas is not used at GCN)
[4] Solar generation estimated as a percent of total electric use (6% in baseline year)
[5] This baseline is an estimation based on peak season
[6] All waste & recycling figures assume 90% capacity in the 6- and 8-yard trash dumpsters & 4-yard recycling container
[7] Current waste provider dumps at Painted Desert Landfill (160 miles one way); Current recycling provider hauls to Flagstaff Hauling and Transfer (75 miles one way)
[8] Based on weekly solid waste pickups and bi-monthly recycling pick ups
[9] Some water usage includes submetered water from businesses on Airport property

among many others. These programs and projects have contributed toward the overall sustainability of the Airport and the entire community. Goals and objectives have been established, along with performance targets, to guide ADOT into the future of its sustainability program. The overall sustainability plan has been established with input from ADOT staff, the master plan advisory committee, and interested members of the public. The result is a sustainability plan that allows ADOT to continually progress toward its sustainability goals. Ultimately, it is the responsibility of the entire Airport staff to ensure sustainability is incorporated into everyday operations and decision-making processes. By continuing existing sustainable practices, coupled with the recommendations in this plan, GCN is well positioned to operate a very green airport that complements the surrounding natural resources. **Exhibit 7D** summarizes the sustainability program at GCN.

AIR QUALITY

Sustainability Goal: Improve regional air quality by reducing GHG emissions from GCN users & enacting policies to reduce emissions from Airport-controlled sources.

At airports, GHG emissions, like CO_2, result primarily from the combustion of fossil fuels which emanate primarily from aircraft engines, public and airside vehicles, and electricity consumption. GHGs have been linked to changes in the Earth's climate, like increased air temperatures, sea level rise, and more frequent and intense storms. Reduction of GHGs could help mitigate some of these effects.

Example Baseline Action: The Airport has implemented anti-idling practices for fleet vehicles, which reduces GHG emissions.

Select Sustainability Actions for Potential Implementation:

- Transition retired Airport vehicles to hybrid or other alternative low-fuel options.
- Upgrade the terminal building's HVAC system to bring in 100% outside air when conditions allow.
- Encourage aircraft operators to perform de-rated take-off or thrust procedures when safe and prudent.

ENERGY

Sustainability Goal: Expand energy efficiency measures and renewable energy opportunities.

Energy conservation initiatives at airports result in direct energy savings. The generation and/or procurement of renewable energy minimizes an airport's dependence on fossil fuels. Both tactics could reduce GCN's utility costs, provide for long-term stability in those costs, and reduce associated GHG emissions.

Example Baseline Action: : The Airport installed a 4.6 kW solar PV system to the ARFF Station, which provides six percent of the building's annual energy needs

Select Sustainability Actions for Potential Implementation:

- Expand solar PV to the terminal building and add on to existing solar capability at the ARFF station.
- Transition all lighting fixtures to LED technology.

NATURAL RESOURCE MANAGEMENT

Sustainability Goal: Incorporate procurement, landscaping, and janitorial practices that reduce the burden on surrounding natural resources.

GCN is uniquely situated amidst the Kaibab National Forest and Grand Canyon National Park, making natural resource management especially important. Natural resource management aims to preserve and protect land, water, soil, plants, and animals, ensuring that current use is not negatively impacting the future needs for these resources.

Example Baseline Action: The Airport practices xeriscaping methods at the ARFF Station, which uses less water than traditional landscaping, and no herbicides or pesticides.

Select Sustainability Actions for Potential Implementation:

- Eliminate herbicides and pesticides use Airport-wide.
- Establish a green cleaning policy (such as LEED O&M) to reduce watershed contamination.

LAND USE

Sustainability Goal: Preserve surrounding environment by encouraging alternative transportation modes to and from the Airport, and reducing noise and light pollution caused by Airport activities.

The FAA guides development of the built environment around an airport to ensure compatibility between an airport and surrounding land uses. This ensures both the safety of surrounding areas, as well as the minimization of noise disturbance that aircraft operations can cause.

Example Baseline Action: The ARFF Station has vehicle parking spaces reserved for those who carpool and/or drive alternatively fueled vehicles.

Select Sustainability Actions for Potential Implementation:

- Extend the Tusayan Park & Ride Shuttle to include a stop at the Airport.
- Promote existing walking trails to Airport visitors and employees as an alternate to driving.

PLANNED DEVELOPMENT

Sustainability Goal: Develop capital improvement projects that consider both present and future needs.

Planned development considers all future construction projects, both on and off Airport property. A capital improvement program generally forecasts the necessary capital, funding source, and timeline of development projects.

Example Baseline Action: The Airport built the ARFF Station in 2010, achieving LEED Gold from USGBC and the Advanced Level Plus Sustainable Building Award from Coconino County.

Select Sustainability Actions for Potential Implementation:

- Incorporate sustainability into Airport planning documents and contracts.
- Require all new or reconstructed developments to achieve LEED certification.

CONSTRUCTION METHODS

Sustainability Goal: Incorporate sustainability into all Airport construction methods.

Construction activities are significant generators of GHG emissions and solid waste, which makes sustainable construction critical. Green construction methods include sourcing materials locally versus shipping from far distances, using products that have low chemical inputs and outputs, reusing materials when appropriate, and designs that reduce the development's carbon footprint (i.e. harvesting rainwater, passive heating/cooling).

Example Baseline Action: The Airport encourages contractors to recycle materials when appropriate, including asphalt and concrete pavement material.

Select Sustainability Actions for Potential Implementation:

- Establish and adopt a green construction policy.
- Reduce the amount of waste related to construction and demolition.

RESILIENCY & PREPAREDNESS

Sustainability Goal: Protect the Airport from climate risks and cyber security threats.

Being prepared for potential threats to GCN like forest fires, and/or cyber security attacks can protect the Airport from catastrophic loss of infrastructure, data, and revenue. A resilient airport is one that can absorb shocks to its operations and maintain the same level of service.

Example Baseline Action: GCN has an Airport Emergency Plan that provides guidance during an emergency occurring at the Airport.

Select Sustainability Actions for Potential Implementation:

- Conduct a resiliency and preparedness study to address the reduction of vulnerabilities.
- Create and adopt an Airport Climate Action Plan.

WASTE MANAGEMENT

Sustainability Goal: Increase waste diversion rate through increased recycling and composting efforts.

Airports generate varying types and amounts of waste that primarily include municipal solid waste, construction and demolition debris, compostable waste, and deplaned waste. Minimizing waste and increasing diversion activities through recycling and composting could reduce related costs and minimize associated environmental impacts.

Example Baseline Action: The Airport currently composts chip trees and maintains a pile of horse manure, which is used for landscaping and soil remediation.

Select Sustainability Actions for Potential Implementation:

- Decrease vehicle miles traveled by solid waste and recycling providers by having as-needed pickups versus scheduled service.
- Begin a food scrap composting program that collects compost from residents, tenants, passengers, and staff that can be used within landscaped areas of the Airport.

WATER

Sustainability Goal: Reduce potable water consumption with expanded efficiency measures and reclaimed/grey water use.

Water is a precious resource in the Grand Canyon and Tusayan area. GCN has previously harvested rain water and processed it for reuse in its buildings; however, this system is no longer operational. Reducing potable water use for activities that could rely on grey or reclaimed water is a critical step in managing the amount of water demanded at the Airport.

Example Baseline Action: GCN encourages on-Airport residents to conserve water by allowing a set amount of usage (gallons) per month.

Select Sustainability Actions for Potential Implementation:

- Re-establish the former rain water containment system on a part of Airport property approved by the FAA.
- Transition all faucets, toilets, and showers to low-flow fixtures.

KEY

ARFF: Aircraft Rescue and Fire Fighting
FAA: Federal Aviation Administration
GCN: Grand Canyon National Park Airport
GHG: Greenhouse gas
HVAC: Heating, ventilation, and air conditioning
LEED O&M: Leadership in Energy and Environmental Design Operations and Maintenance
LED: Light-emitting diode
PV: Photovoltaic
USGBC: United States Green Building Council